INTRODUCTION

Forensic medicine 00:01:00

- It deals with the medical aspects of law
- **Article 21 in the constitution of India 1949**
  - Protection of life and personal liberty – no person shall be deprived of his life or personal liberty except according to procedure established by law.

Medical jurisprudence 00:04:52

- It deals with the legal aspects of medicine

Medical ethics 00:06:07

- It deals with three relationships:
  - Doctor – doctor relationship
  - Doctor – patient relationship
  - Doctor – state relationship

Medical etiquette 00:06:50

- It deals only with → Doctor – doctor relationship

Terminologies 00:08:00

- Men's rea → Guilty mind
- Actus rea → Guilty act

- Mutatis mutandis → The necessary changes having been made
- Pari passu → Equal in all respects
- Ultra vires → Beyond the power

Extra Edge topics 00:11:27

The father of Forensic Medicine	Paolo Zacchia (1584-1659)
The father of modern Forensic Medicine	Bernard Spilsbury (1877 – 1947)
The father of Toxicology	Paracelsus (1493 – 15410
The father of Modern Toxicology	Mathieu Orfila (1787 – 1853)
The oldest medico-legal code	Code of Hammurabi
First medico legal autopsy in the world was done by	Bartolomeo Varignana, in Italy in 1302
First book of Forensic Medicine was written by	Furtunato Fedele, an Italian in 1602
First postmortem in India was done by	Dr Buckley in Madras in 1663, a case of suspected Arsenic poisoning

LEGAL PROCEDURE PART-I

Basics of legal procedure 00:00:22

- Victim – someone who has been hurt or killed
- Assailant – a person who commits criminal assault
- Accused – a person who has been arrested for or formally charged with a crime
- Plaintiff – the party who brings the legal action (who files a case)
- Defendant – the party who is being sued or in a criminal case, the person accused of committing a crime
- Respondent – a person who replies to something

Offense 00:02:58

- Cognizable offense → The police officer can arrest a person without warrant

  Example: Rape, dowry death, ragging, murder, kidnapping, theft etc.
- Non – cognizable offense → The police officer cannot arrest a person without warrant.

  Example: Forgery, cheating, assault, suicidal attempt etc.
- Summons cases → Offences for which imprisonment is less than 2 years

- Warrant cases → Offences for which imprisonment is more than 2 years

Heinous crime 00:04:55

- A crime for which imprisonment is 7 years or more.

Criminal courts in India 00:07:15

1. **Supreme court** (1 in India) – All powers
2. **High court** (25 in India) – All powers
3. **Sessions court** (District sessions court) - All powers; But death sentence should be confirmed by the high court.
4. **Assistant sessions court** - Can pass up to 10 years of imprisonment.

(In Supreme court and High courts there is no trial, only appeal.)

Magistrate's court 00:11:11

Magistrate's court	**Imprisonment**	**Fine up to**
Judicial Magistrate of Second Class (JMSC)	Up to 1 year	Rs.5,000
Judicial Magistrate of First Class (JMFC)	Up to 3 years	Rs.10,000
Chief Judicial Magistrate (CJM)	Up to 7 years	Unlimited

Juvenile 00:15:26

- A boy or girl below 18 years.
- The trial takes place in Juvenile Justice Board (JJB).
- The board consists of 3 members, presided over by
  i. JMFC (preferably female)
  ii. Female social worker (Must be present)
  iii. Male social worker
- If a juvenile commits a crime, then maximum 3 years of imprisonment; But in cases of a juvenile aged between 16 and 18 years involved in a heinous crime, then they will be tried as an adult. But no Life imprisonment and death sentence

Juvenile and punishment 00:21:52

- **Section 82 IPC**
  - A child below the age of 7 years is not liable for any criminal act.
- **Section 83 IPC**
  - A child between the age of 7 and 12 years may/may not be held liable for any criminal act, depending on mental maturity.
  - If the child is mentally not matured → No punishment.
  - If the child is mentally matured → Maximum 3 years.
- **> 12 but <16 years**

  - Any crime committed is punishable; maximum up to 3 years of imprisonment
- **>16 but <18 years**
  - Any crime committed other than heinous crime is punishable maximum up to 3 years of imprisonment.
  - Any heinous crime committed, more than 3 years imprisonment can be given, but no life imprisonment or death sentence.
- **>18 years** → Full criminal responsibility
- Minimum age of a person who can be punished **under Indian railway act** is 12 years.
- If the child born is appointed a guardian or he/she is under court of wards, then he/she attains majority after his completion of 21 years of age.
- The age of attaining majority for a juvenile in conflict with law is 21 years.

Inquest 00:35:17

- Inquest is a legal or judicial inquiry to ascertain a matter of fact.
- Inquest held in India

  i. **Police inquest (174 Cr Pc)**
    - It is the most common type of inquest.
    - The minimum rank of police who can hold inquest is head constable of police.

  ii. **Magistrate's inquest (176 Cr PC)**

- Judicial → CJM, JMFC, JMSC
- Executive/Non- judicial → Dist. Magistrate (DM), Additional DM, Sub-divisional magistrate (SDM), District Commissioner/Collector, Asst. Commissioner/Collector, Tahsildar, Deputy Tahsildar.

iii. **Coroner's inquest**

- It was abolished on 1978 in Kolkata and on 1999 in Mumbai
- It is currently held in U.K, Australia, Canada, Hong kong, Ireland, New Zealand, Poland, Sri Lanka and some states in USA.

Open verdict 00:39:44

- Announcement of the commission of crime by the coroner without naming the accused.
- Done when the accused was not found.

Executive magistrate inquest 00:41:49

Indications

- Suicide/suspicious death of a women within 7 years of her marriage.
- Exhumation
- Death caused/suspected to be caused by police.

Judicial Magistrate's inquest 00:44:31

- It is compulsory in cases of Death/Disappearance/Rape in police custody or in any other custody authorized by the Magistrate/Court. (Jail, Remand home, Borstal school, Psychiatric hospital etc.)

Procurator fiscal system 00:48:07

- It is held in Scotland

Medical examiner system 00:48:31

- It is held in USA
- It is the best form of inquest

Death sentence and life imprisonment can be commuted by 00:50:45

Commutation = reduction of penalty

a) President of India (Article 72 of constitution of India)

b) Governor of state (Article 161 of constitution of India)

c) Central/State government (54 IPC → Death sentence, 55 IPC → Life imprisonment)

d) Higher court

- The power of amnesty for capital punishment is vested with the president of India.

Extra Edge topics 00:53:35

Criminal Offences

- These are offences against:
  - Public interest
  - Property
  - Person
  - Public safety and security
- E.g., Murder, Rape, Robbery, theft etc.
- These are taken as offences against the state
- In this, State is a party and represented by the Public Prosecutor

Civil Offences

- These are dispute between two persons or parties
- E.g., Land dispute, Divorce, Compensation etc.

Indian Penal Code (I.P.C.) 1860

- It deals with criminal laws in India
- It describes offences and their punishments
- There are XXIII Chapters and 511 sections of I.P.C.

Criminal Procedure Code (Cr.P.C.) 1861 – amended in 1973

- CrPC deals with the legal procedures in various criminal matters

- It provides the machinery for the
  - Investigation of crime
  - Apprehension of suspected criminals
  - Collection of evidence
  - Determination of guilt or innocence of the accused person and
  - The determination of punishment of the guilty
- Additionally, it also deals with Public nuisance, Prevention of offences and Maintenance of wife, child and parents
- There are 37 chapters and 484 sections of Cr.P.C.

Indian Evidence Act (I.E.A.) 1872

- I.E.A. deals with the laws of evidence and applies in judicial proceedings
- It contains a set of rules and allied issues governing
  - Admissibility of evidence in the Indian courts of law
- There are 11 chapters and 167 sections of I.E.A.

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LEGAL PROCEDURE PART-II

Court procedures

Summons (Subpoena) – 61 to 69 CrPC

00:00:20

- It is a legal document compelling the attendance of a person in a court of law, under penalty.
- There are two types of summons
  - **Subpoena Ad testificandum** → Oral evidence
  - **Subpoena Ducis Tecum** → Production of documents +/– oral evidence
  - It is compulsory to attend both civil and criminal courts.
- **174 IPC** → Non-attendance in obedience to an order from public servant
- **172 IPC** → Absconding to avoid service of summons

Attending to summons

00:07:19

- Higher court > lower court
- If same level, criminal > civil
- If same level, either civil/criminal → whichever received early

Expenses of the witness to attend the court

00:11:19

A. Civil cases

- Expenses are given by the party
- The money given is known as conduct money
- Conduct money is decided by the judge

B.Criminal cases

- Expenses are given by the Government
- The money given here is known as travelling and dearness allowance – T.A. & D.A. (312 Cr Pc)

Evidence (3 IEA) 00:16:00

1.Oral evidence

a)Direct oral evidence → Evidence of an eyewitness (The one who has personal knowledge about the fact) → Best form of evidence because it allows cross examination.

b)Indirect oral evidence (hearsay evidence)→ Evidence of a person who does not have personal knowledge about the fact.

2.Documentary evidence

a)Medical certificates → Required for day-to-day life (Sickness/fitness/physical fitness/vaccination/Death certificate etc.)

b) Medicolegal reports → Issued at the request of the Investigating Officer
(Wound/P.M. Certificate, reports on Examination of accused/victim of rape, sodomy, bestiality etc.)

3. Circumstantial evidence → An inference can be drawn by the circumstances

Dying declaration (32 IEA) 00:25:11

- Anybody can record, but best is Magistrate
- No leading questions shall be asked
- No interpretation of signs
- Witness should be present
- Invalid, if incomplete
- To be submitted to the magistrate at the earliest

Medico legal importance (M.L.I)

- If dies → Retains full legal validity
- If survives → Loses validity but acts as corroborative evidence

Dying deposition 00:32:01

- Recorded only by a Magistrate under oath, in the presence of accused or his lawyer.
- Cross examination is allowed
- It is only a hypothetical situation and not practiced in India

- It is more valid than dying declaration

Medico legal importance (M.L.I)

- Whether dies or survives → Retains full legal validity

Exceptions to oral evidence 00:37:50

- Dying declaration
- Expert opinion expressed in a treatise
- Evidence of a doctor recorded in a lower court
- Evidence given by a witness in a previous judicial proceeding
- Evidence of mint officer or any officer of India security press
- Reports of certain government scientific experts, such as chemical examiner, chief inspector of explosives, Director of fingerprint bureau, Director of central forensic science laboratory, serologist etc.
- Public records (passport, Aadhaar card etc.)
- Hospital records: Routine entries such as DOA, DOD, Pulse, temp. etc.
- When the certificate or documents are acceptable to the counsels (lawyer of accused) without cross – examination etc.
    - Medico-legal reports are accepted in a court of law, only after cross examination, unless the opposite

lawyer is willing to accept without cross examination.

Witness 00:41:45

- There are 2 types

  i. Common/ordinary (Firsthand knowledge)

  ii. Expert witness (45 IEA) (a specialist)
- A doctor is both a common and an expert witness
- Both can become Hostile (154 IEA)
- A hostile witness is the one who contradicts his own statement, or
- A hostile witness is the one who gives evidence against the interest of the party that cited him as witness.
- A hostile conceals a part of the truth or the whole truth or gives adverse testimony to his own party during the trial

Dumb witness 00:47:28

- A dumb witness can testify in a court of law
- Can testify by signs in an open court
- Can testify by writing in an open court
- Can testify by signs to leading questions

51 IPC 00:48:32

- 51 IPC defines both Oath (taken by a theist) and Solemn affirmation (Taken by a theist)

Perjury 00:50:30

- Perjury: Lying under oath/giving false evidence under oath or solemn affirmation is known as perjury
  - **Defined under 191 IPC**
  - **Punishable under 193 IPC**
- Minimum age to take oath is 12 years.
- Witness is liable for prosecution if he does not take oath → 178 IPC

IPC 00:54:13

- 191 → Giving false evidence (perjury) – Definition
- 192 → Fabricating false evidence – Definition
- 193 → punishment for section 191, 192, 197 IPC (Up to 7 years of imprisonment)
- 197 → Issuing or signing false certificate – Definition

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Leading question (141 I.E.A) 00:58:08

- Leading question is the one which suggests its own answer
- Can be answered by 'yes' or 'no'

Recording of evidence 00:59:16

i. **Chief/Direct examination**

- Done by the same lawyer
- No leading questions

ii. **Cross examination**

- Done by the opposite lawyer
- Leading questions can be asked (141 IEA)

iii. Re-examination

- Done by the same lawyer
- No leading questions

iv. Re-cross examination

- Done by the opposite lawyer
- leading questions can be asked

v. Court questions

- Judge can ask questions at any time during the trial.

- In chief examination and re-examination, no leading questions shall be asked unless the witness turns hostile.
- Leading questions must not be asked in an examination-in-chief or in a re-examination except with the permission of the court (sec. 142 IEA)
- Cross examination by defense lawyer is done to protect the accused.
- Cross examination may act as a double-edged knife.

MEDICAL LAW AND ETHICS PART - I

Basics and consent-I

Principles of medical ethics 00:00:20

1. Respect for autonomy – respect the rights of the patient.
2. Non maleficence – do no harm
3. Beneficence – Action done for the benefit of others.
4. Justice – treat all the people equally and impartially.

National Medical Commission (NMC) Act 00:02:15

- National Medical commission Act was passed in the year 2019
- NMC came into force from September 25th, 2020.

Recognition of medical qualification (M.Q) by NMC 00:02:48

- First schedule → M.Q. awarded by Indian universities
- Second schedule → M.Q. awarded by foreign universities
- Third schedule →
  - Part 1 – M.Q.s awarded by Indian universities not included in Schedule 1.
  - Part 2 – M.Q.s awarded by foreign universities not included in schedule 2.
- DNB degree is recognized under First schedule.

Functions of State Medical Council (SMC)

00:05:59

- Maintaining Medical register
- Issuing warning notice
- Disciplinary action against doctors

Warning notice 00:07:50

- It is a code of conduct prescribed by SMC/NMC.
- Violation of warning notice amount to professional misconduct.
- It is issued to all doctors at the time of registration.

Professional misconduct (Infamous conduct)

00:09:38

1.Treating the patient under the influence of **A**lcohol.

2.**A**ddiction

3.Criminal **A**bortion

4.**A**ssociation with unqualified people

5.**A**dultery (Improper conduct)

6.Repeated **A**dvertisement

7.Covering

- Having relation with uncertified/unqualified persons, which enable them to practice medicine, midwifery or to perform surgery in the name of RMP.

8.Dichotomy

- Fee splitting → receiving or giving commission.

9.Canvassing

- Engaging agents/touts to attract patients

Medical records (MR) 00:15:29

- As per NMC:
  - In patient's MRs should be stored for 3 years.
  - MRs should be given within 72 hours on request by the patient/ authorized representative of the patient.
- As per Director General of Health Services (DGHS):
  - MRs of both OP and IP is stored in hard copy for 3 years.
  - MRs of IPs is stored in digitalized form – indefinitely
  - Medico–legal registers and case sheets are stored for 10 years or till the disposal of related ongoing cases in courts.

Disciplinary control by SMC 00:18:24

- Disciplinary action on 3 grounds:
  i. If a doctor is convicted by a court of law for offences involving moral turpitude.
  ii. When a complaint is lodged against the doctor stating that he is indulging in disciplinary action.
  iii. Suo moto – without conviction i.e. of its own accord.

- Actions taken by SMC
    i. Warning
    ii. Monetary penalty
    iii. Penal erasure – Doctor is penalized by removal of his name from the medical register.

      Penal erasure can by Temporary or Permanent (Professional death sentence)

      The doctor can appeal as follows:
        - First appeal → To Ethics and Medical registration board
        - Second appeal → To NMC
        - However, doctor can also appeal to High court or Supreme court.

Red cross emblem 00:28:50

- It can be used by members of
    - Medical division of armed forces and
    - Red cross society, during war and while keeping/maintaining peace.
- Unauthorized use of red cross emblem can lead to
    - Fine up to Rs. 500 and
    - Forfeiture of the goods upon which emblem was used.

Professional secrecy 00:30:46

- It is an implied term of contract between doctor and patient.

Privileged communication 00:32:10

- The registered medical practitioner can disclose the secretes of a patient
  - In a court of law under the orders of the presiding judge.
  - When there is a serious and identified risk to a specific person and/ or to the community.
  - Notifiable diseases and incidents (Birth, death, MLC etc.)

Declarations 00:40:58

- The modernized versions of the Hippocratic oath comprise the declaration of Geneva.
- Declaration of Oslo → therapeutic abortion
- Declaration of Helsinki → Human experimentation
- Declaration of Tokyo → Torture and medicine

Extra Edge topics 00:44:08

- The National Medical Commission Act was passed in the year 2019
- National Medical Commission (NMC) came into force from Sep. 25, 2020

- NMC consists of the following persons to be appointed by the Central Govt., namely: —

  a) a chairperson;

  b) 10 Ex officio Members; and

  c) 22 Part-time Members

Functions Of NMC

1. Maintaining a high quality and high standards in medical education
2. Regulating medical institutions, medical researches and medical professionals
3. Assessment of healthcare requirements including human resources
4. Framing guidelines and laying policies for the Promotion and co-ordination for the proper functioning of the Commission, the Autonomous Boards and the State Medical Councils
5. Ensure co-ordination among the Autonomous Boards
6. Ensuring effective functioning of the State Medical Councils
7. Exercise appellate jurisdiction with respect to the decisions of the Autonomous Boards
8. Laying down policies and codes to ensure professional ethics in medical profession

9. Framing guidelines for determination of fees and all other charges in respect of 50% of seats in private medical institutions and deemed to be universities
10. Conducting National Eligibility cum-Entrance Test and National Exit Test
11. Supervision of Autonomous boards namely;
    - a) the Under-Graduate Medical Education Board;
    - b) the Post-Graduate Medical Education Board;
    - c) the Medical Assessment and Rating Board; and
    - d) the Ethics and Medical Registration Board (It maintains the National Medical register)

Health related declarations of world medical association	
Declaration of Geneva	Modernized version of Hippocratic oath
Declaration of Tokyo	Torture and other cruel and degrading treatment or punishment
Declaration of Helsinki	Human experimentations and clinical trials
Declaration of Oslo	Therapeutic abortion
Declaration of Sydney	Definition of death (Brain death)

Declaration of Malta	Role of doctor in hunger strike
Declaration of Madrid	Professional autonomy and self-regulation
Declaration of London	International code of medical ethics
Declaration of Lisbon	The rights of the patient
Declaration of Munich	Racial political discrimination etc. in medicine
Declaration of Hamburg	Support for doctors refusing to participate in torture or other forms of cruel inhuman or degrading treatment
Declaration of Venice	Terminal illness
Declaration of Istanbul	Organ trafficking and transplant tourism

MEDICAL LAW AND ETHICS, PART - 2 – CONSENT

Consent (section 13 ICA) 00:00:10

A. Consent can be:

i. Implied consent → by demeanor of the person. It is only for General physical examination and excludes PV and PR examination.

ii. Expressed consent

- Verbal
- Written

Written consent 00:03:50

There are 2 types

- Full disclosure:
  - After full disclosure if consent is given, it is known as informed consent. It is the best consent.
  - After full disclosure if the patient does not consent, then it is known as informed refusal.
- Partial disclosure:
  - In case of psychological harm, then the doctor can withhold certain information. This is known as therapeutic privilege or discrete disclosure.
- BLANKET CONSENT: It is the consent taken at the time of admission for any surgery.

  As it is nonspecific, it is invalid.

- A patient suffering from a contagious disease should be treated even if he does not consent.

Loco parentis 00:13:35

- It is about consent.
  - In an emergency involving children, when parents/legal guardians are not available, consent from the person– in–charge of that child can be taken.

Age and consent 00:14:22

- **<12 years**, the child cannot give consent under 90 IPC. Here, the parent/guardian can give consent under 89 IPC.
- **12-18 years**
  - The person can give consent only for General physical examination and excludes PV/PR examination.
  - No blood test, no injection, no x-ray.
- **>18 years**
  - Consent can be given for any act, that is not intended to cause death/grievous hurt - under Section 87 IPC
- Minimum age of a person who can give consent for age determination is 18 years.

Consent is not required in case of emergency (92 IPC) 00:17:57

i. Children – for the benefit of the child, even without consent, one can proceed with the management

ii. Incompetent person – When the person is unconscious or intoxicated or mentally ill.

  - Section 92 IPC – Act done in good faith for benefit of a person without consent.

Surrogate/proxy/substitute consent 00:20:24

- Consent not given by patient himself, but given by some other person on his behalf.
- In case of minor and incompetent patients.

Extended doctrine of implied consent 00:21:09

- Also known as doctrine of extended consent
- It is circumstances where the factors surrounding are deemed reasonable and appropriate.

Article 21 in the constitution of India 1949

- Protection of life and personal liberty - No person shall be deprived of his life or personal liberty except according to procedure established by law.

MEDICAL LAW AND ETHICS PART-II

(MEDICAL NEGLIGENCE)

Medical negligence (Malpractice) 00:00:26

It is an act of

- Commission → Doing something, which is not to be done.
- Omission → Not doing something, which is to be done.

Autonomy 00:01:50

- Autonomy means one's own rights on his body.
- Paternalism → Disrespecting the autonomy
  Example: operation without consent → Technically it amounts to assault (352 IPC)

Negligence 00:03:25

- It can be of 2 types:

i. Civil negligence:

- Patient sues the doctor for compensation (Damages).
- It is dealt under law of tort. (Civil wrong)

ii. Criminal negligence:

- Illegal act (example: criminal abortion)
- Gross ignorance (example: operation on wrong patient)

- Undue interference (example: paternalism)
  - In suits of criminal negligence, the court of law may award penalty in the form of → fine or Imprisonment or both.
  - In addition, a civil court may award damages.
  - Almost always criminal negligence is associated with civil suits.

Ingredients (elements) of negligence 00:09:00

i. Duty of care:

- It is up to the doctor whether to accept or reject a patient
- Once the doctor accepts a patient, he should continue to treat; if not it amounts to professional misconduct.
- Should take reasonable care and use reasonable skill.

ii. Dereliction

- Absence of reasonable care and reasonable skill.
- Bolam test: A doctor is not negligent, if he reaches the standard of a responsible body of medical opinion. It is named after John Bolam.

iii. Damage

- It is the harm (injury/disability/death) caused to the patient.

iv. Direct causation

- Damage should be as a direct result of dereliction.

v. Reasonable foreseeability of the damage

- It is an intelligent anticipation of the outcome of the treatment

In case of medical negligence, the burden of proof lies on the patient.

I.P.C Sections related to rash and negligent act

00:18:24

- Endangering life → 336
- Causing hurt → 337
- Causing grievous hurt → 338
- Causing death → 304 (A) (up to 2 years imprisonment)

Other I.P.Cs related to medical negligence

- 312 – 316 → Causing miscarriage
- 341 → punishment for wrongful restraint
- 342 → Punishment for wrongful confinement
- 352 → Punishment for assault (operation without consent)
- 269 → Negligent act likely to spread infection/disease dangerous to life.
- 270 → Malignant act likely to spread infection/disease dangerous to life.
- 271 → Disobedience to quarantine rule.

- 284 → Negligent conduct with respect to poisonous substance.

  All deaths during anesthesia and surgery should be reported to police under sec 39 Cr PC.

Defences in medical negligence 00:31:03

1.No defence

- **Res ipsa loquitur** → The things speak for itself.

  E.g., a) Operation on wrong patient/limb/eye/organ.

  b) Keeping a surgical instrument / swab in the body cavity after Operation.

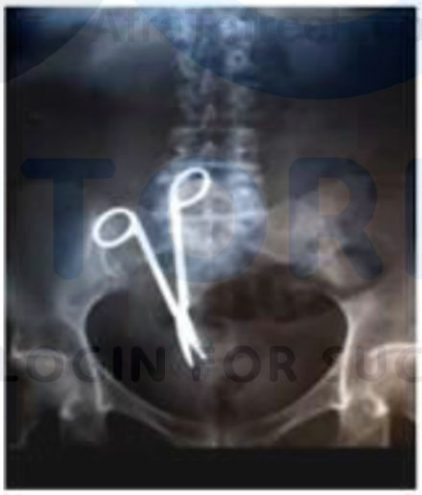

Fig: 1

c) Prescription of an overdose.

2.Partial defence

- Contributory/concurrent negligence → Both the doctor and patient are negligent.

  Contributory negligence is a defense only in civil malpractice.

Avoidable consequence rule → Patient could have avoided the complication.

Last clear chance doctrine → Doctor had a clear chance to rectify the complication.

3.Complete defence.

- No duty owed
- Duty discharged according to the prevailing standard
- No damage
- No direct causation
- No reasonable foreseeability
- Novus actus intervenience (= New acting intervening)
  - Events to be taken place has been intervened by an unforeseen, unexpected new event (Breaking the chain of consequences/ events).
- Product liability
  - Manufacturer is liable
- Corporate negligence
  - Hospital is negligent
- Error of judgement
- Misadventure
  - An unfortunate incident, a mishap, an inadvertent act

    Example: Patient dies of anaphylactic shock for the test dose itself.

Misadventure is of 3 types

i. Therapeutic misadventure → During treatment
ii. Diagnostic misadventure → During diagnosis
iii. Experimental misadventure → During experimentation

- Medical maloccurence
  - Despite of proper treatment (absolutely no negligence), the patient has not responded for the treatment.
- Calculated risk doctrine
  - Inevitable risk in certain medical procedures.
- Volenti non-fit injuria
  - If someone willingly places himself in a position where harm might result, he cannot claim against other party.
- Res Indica (law of limitation)
  - A patient can sue a doctor for civil negligence up to 2 years after the knowledge of the damage.
  - No such time limit in criminal cases.
- Res judicata
  - Once the court case is finalized, it cannot be revoked again in the same court or same level of court
  - Appeal can be made to the higher court.

Composite negligence 01:15:24

- It means negligence by more than one person.

Vicarious liability/responsibility 01:16:10

- Not the one who is negligent, but some other person is held liable/responsible to pay the damages in a civil suit (Not in criminal case) → Under the principle of respondent superior, i.e., let the master answer → the employer is responsible for employee's negligence.
- For vicarious liability
  - There must be employer- employee relationship
  - Employee's conduct must occur within the scope of his employment.
  - Employee's negligence must occur while on the job.

Borrowed servant doctrine 01:24:29

- If an employee is borrowed from the principal employer, then the temporary new employer will be held liable for any negligent act of the employee.

Captain of the ship doctrine 01:28:53

- Head of the team (For example, in a surgery, the chief surgeon) is answerable for his subordinate's negligence.

IDENTIFICATION PART – I

Corpus delicti 00:00:21

- Corpus = Body, delicti = Offence
- Corpus delicti means, Body of crime or body of offence or Essence of crime or Element of crime.

Features in different races 00:01:47

1.Mongolians

- Shovel shaped incisors → Due to peripheral ridges
  - Also seen in native north Americans

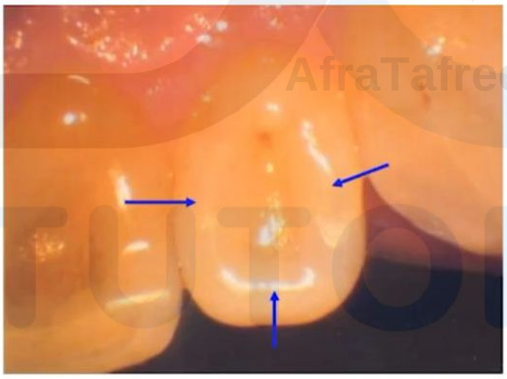

Fig: 1

- Taurodontism/Bull tooth
  - Wide and deep molar pulp cavity

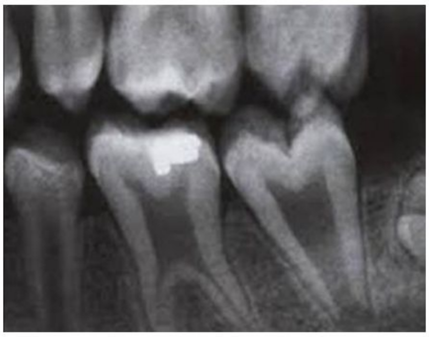

Fig: 2

- Long pointed canines

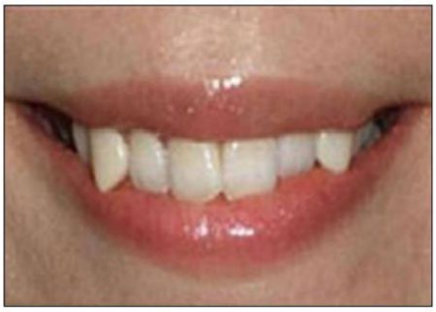

Fig: 3

- Ectopic pearl/Enamel pearl
  - At the bifurcation or furcation of root.

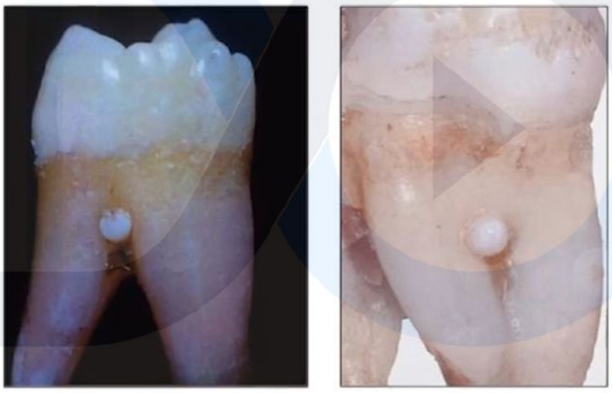

Fig: 4

- Frequent absence of upper 3rd molars
- Largest teeth

Fig: 5

2.Caucasoids

- Carabelli cusps → additional cusp in upper 1st molar.

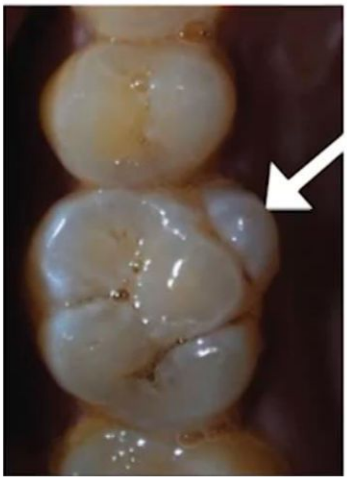

Fig: 6

3. Negroids
    - Distinct femur → less curved femur

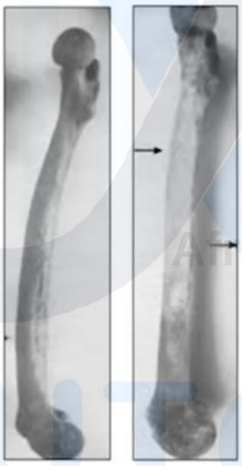

Fig: 7

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Hair 00:05:30

- Scale pattern of human is Moritz type VII

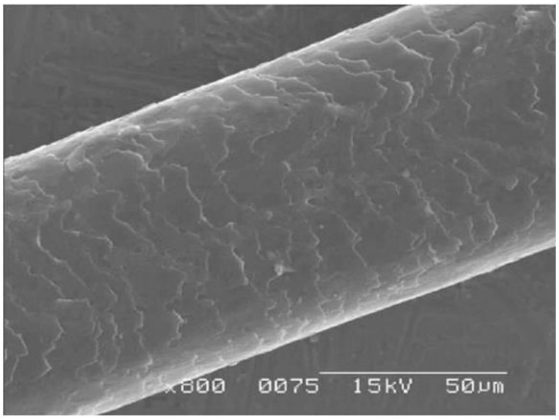

Fig: 8

Medulla of hair

- In animals → Medulla of hair is thick (Medullary index: >0.5)

  And is always continuous

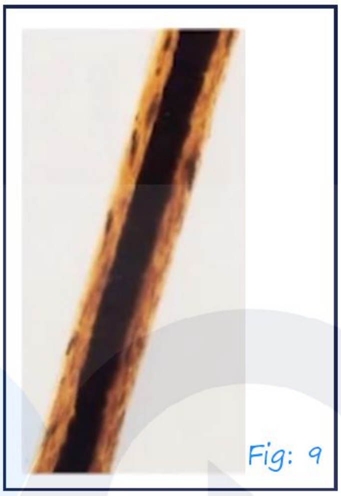

Fig: 9

- In humans → Medulla of hair is thin (Medullary index: <0.3)

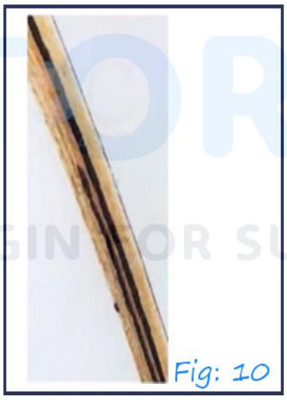

Fig: 10

- It may be continuous/fragmented/absent
- Usually continuous in mongoloids

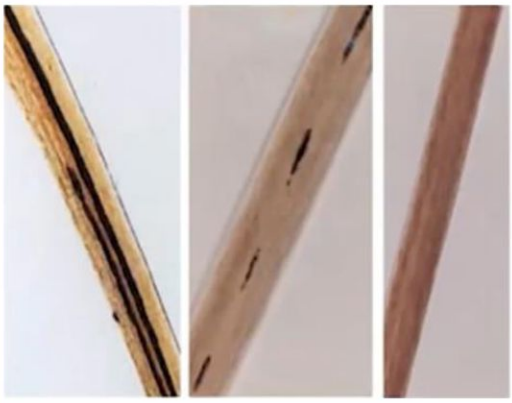

Fig: 11

BARR body (Sex chromatin) 00:08:18

- Inactivated X-chromosome

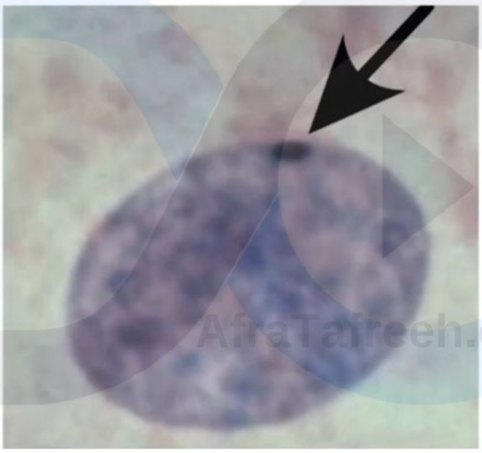

Fig: 12

- Seen in 30-40% of female cells (0.4% of cells in males)

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Davidson body 00:09:47

- Drumstick like appearance in neutrophils of females.

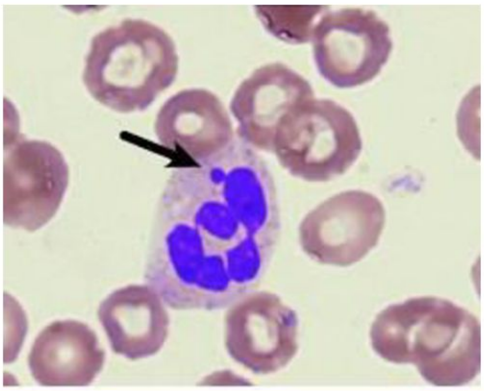


Fig: 13

- Seen in 3-6% of female cells (Absent in males)
- Best stain for X chromosome is Feulgen reaction using Acriflavine Schiff reagent.
- Quinacrine dihydrochloride → For Y chromosome
- Y chromosome in dental pulp can be demonstrated up to 1 year in decomposed bodies.

Disorders of sexual development (DSD) 00:11:58

1. Sex chromosome DSD
   - Klinefelter's syndrome
   - Turners syndrome
2. 46, XY DSD (previously known as male pseudo-hermaphroditism)
   - The external genitalia are of female form
3. 46, XX DSD (previously known as female pseudo-hermaphroditism)
   - The external genitalia are of male form
4. 46, XX ovo-testicular DSD (previously known as true hermaphroditism)
   - Presence of both ovaries and testis.

Height of a child 00:14:30

- Full term → about 50 cm
- 6 months → about 60 cm
- 1 year → about 68 cm
- At 4yrs → about 90-100cm (twice the birth height)

Weight of a child 00:15:00

- At birth → about 3 to 3.5kg
- 6 months → doubles (6-7kg)
- 1 yr → triples (9-10 kg)
- Child brain attains mature size and weight at about 6 years.
- The commonest heart defect in Turner's syndrome is bicuspid aortic valve.
- Sex determination of an athlete with disputed sex in Olympics is done by **hormone studies**.

Estimation of gestational age by crown-heel length (CHL) 00:16:23

- Rule of Haase → If CHL is <25cm, gestational age in lunar months is equal to √ of CHL
- Morrison's rule → If CHL is >25cm, gestational age in lunar months is equal to CHL/5
- As per Obstetrics, a fetus Of 2 months will be measuring 2-2.5cm in length and weighing 10gm
- Crown rump length (CRL) ≈ 2/3rd of CHL

  Or CHL ≈ 1.5 x CRL

  - Sex of the foetus can be recognized earliest at 4th month.
  - In a foetus nails reach the tip of the fingers at 8th month.

Bertillon system or Anthropometry (Portrate Parle) 00:20:18

- Helpful even if there are no biological specimens.
  - Descriptive data → Complexion, color of hair & iris, shape of nose, lips, chin etc.
  - Body
  - marks → Moles, birth marks, scars etc.
  - Body measurements → 11 in number
    - Standing height
    - Sitting height
    - Length of the head
    - Breadth of the head
    - Breadth of the face
    - Distance between two outstretched upper limbs
    - Length of left forearm and hand
    - Length of left middle finger
    - Length of left little finger
    - Length of left foot and
    - Length of right ear

Dactylography (Fingerprint system, Galton system, Dermatoglyphics) 00:22:35

- Fingerprints are discovered by sir William J Herschel.
- Finger printing was first used for criminal case by Juan Vucetich.

- The first fingerprint bureau was established at Calcutta.
- The most reliable method of identification of an individual is dactylography.
- Chances of two persons having identical fingerprints is about 1 in 64,000,000,000

Quetelet's rule:

- Every nature made objects shows infinite variations of forms, and In the world's crime records, no two identical fingerprint patterns have been reported
- Even identical twins have different fingerprints; therefore, it is best to differentiate identical twins.
- But identical twins have same DNA finger printing → best to identify identical twins.
- Ridges on the fingerprints are detected up to depth of 0.6mm.
- The finger prints develop at 12-16 weeks if I.U.L.

Fingerprint pattern 00:27:37

1. Loops (67%) – Most common type
2. Whorls (25%) – Whorls may be clockwise or anti clockwise
3. Arches (7%) – Arches can be plain or tented
4. Composite (1%)

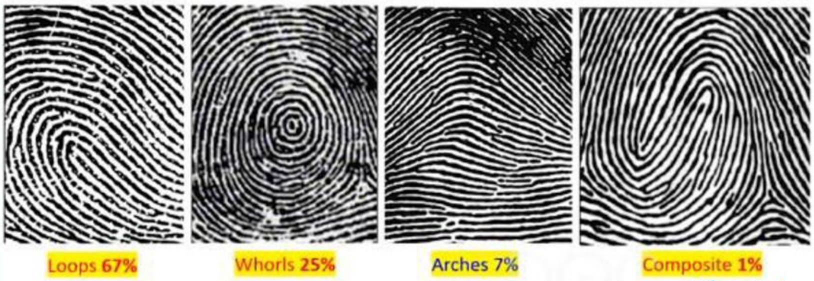

Loops 67%
Whorls 25%
Arches 7%
Composite 1%

Fig: 14

- Central pocket loop is a variety of composite fingerprint
- A whorl embedded in a loop

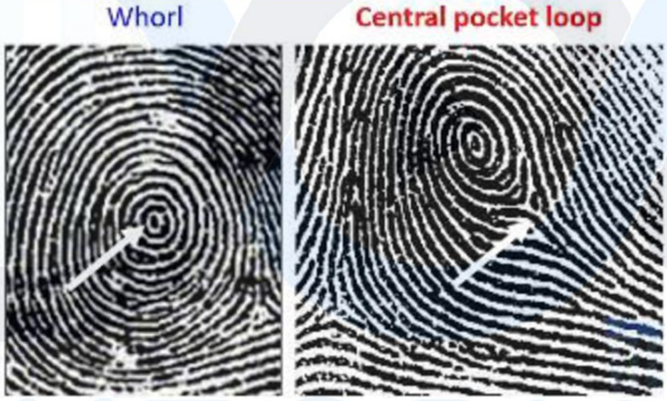

Whorl
Central pocket loop

Fig: 15

Fingerprints 00:29:50

- Invisible/Latent/chance (most common)
- Visible/Patent

Fig: 16

- Plastic/indented/molded

i. Seen on Soap, cheese, butter, Putty, cellotape etc.

Fig: 17

Minimum points of similarity required in partial fingerprinting 00:31:39

- Varies from country to country > 8 (As per supreme court ruling) > 16
- In fingerprint reader (FINDER), prints of 8 fingers are recorded except little finger

Recognition of latent fingerprints 00:33:29

- Physical method
  - By dusting contrast colored powder

Fig: 18

- Chemical method
  - Spray chemical on suspected area like

- Ninhydrin

Fig: 19

- Silver nitrate

Fig: 20

- Iodine fumes

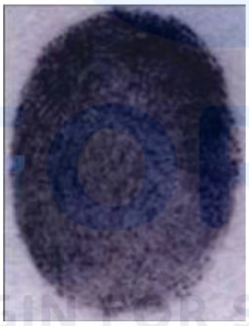


Fig: 21

- Autoradiography
  - Radiography after dusting BasO4, PbCO3

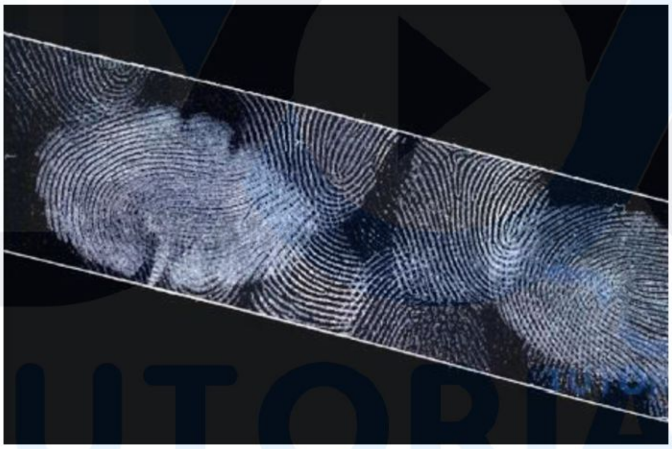
$BaSO_4$, $PbCO_3$

Fig: 22

- LASER

Fig: 23

  - Most sensitive are fluorescence examination with LASER
  - Fingerprints can be lifted by cello tape



Conditions altering fingerprints Fig: 24

- The fingerprint pattern may be impaired permanently in cases of
  - Leprosy
  - Charring
  - Radiation
  - Electrical injuries
  - Corrosives
- Ridge alteration:

  - Eczema, acanthosis nigrans, scleroderma, dry and atrophic skin.
- Complete loss of pattern with ridge atrophy:
  - Coeliac disease
- Change in the distance between ridges but without change in pattern:
  - Rickets and acromegaly
- Incomplete ridge atrophy
  - dermatitis

Finger prints in case of decomposed bodies

00:37:40

- The degloved skin of a putrified body is kept in 10% formalin
- If the fingers are shrivelled:
  - Immersed in 20% acetic acid for 1-2 days
- If the skin is dehydrated
  - OThe finger is soaked in 3% solution of potassium hydroxide

Sir Edmund Locard 00:48:43

- He is known for his 2 discoveries

  1. Locard's principle of exchange

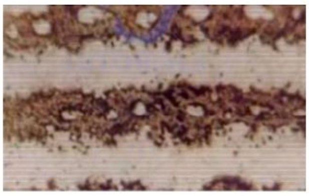
  ↓

  Mutual transfer of material from one object to other

  2. Locard's method (Poroscopy)

  ↓

  Identification of a person by the study of opening of sweat ducts on fingers ridges



  ↓

  Useful when only fragmentary fingerprints are available

- Each mm of finger ridge contains 9-18 pores (thousands per square cm)

Podogram 00:42:20

- It is the study of foot prints
- Foot prints of newborn infants are used in some maternity hospitals
  - To prevent exchange or substitution of infants.
- Foot prints are taken as a record in Airforce personnel
- Foot prints are also taken in civilian and commercial air crew

Palatoscopy/Rugoscopy 00:43:19

- Discovered by Harrison Allen
- Anterior palate (1/3rd) is preferred over posterior part.

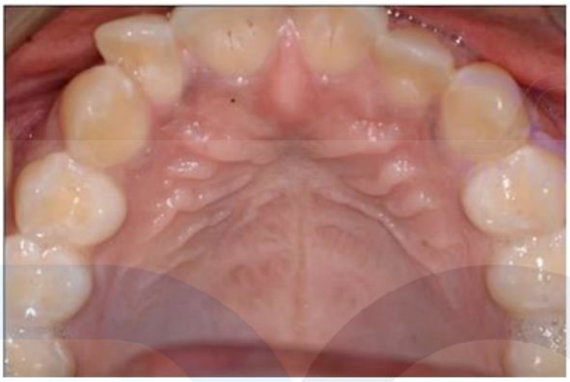


Fig: 25

- Palatoprints do not change during growth.
  - Primary rugae: 5mm or more
  - Secondary rugae: 3-5mm
  - Fragmentary rugae: <3mm

Cheiloscopy/Lip prints 00:45:11

- Lip prints also varies from person to person.
- Study of lip prints is known as cheiloscopy
- Lip prints are originally classified by Suzuki and Tsuchihashi into 6 types:

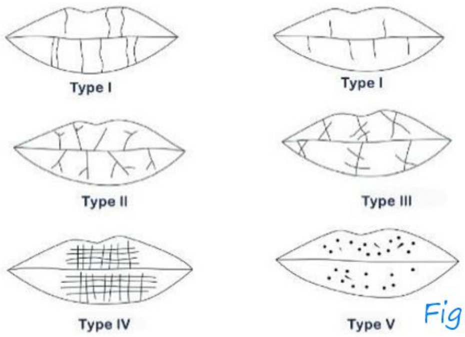


Fig: 26

- Type I – Vertical & complete
- Type I* – Vertical but incomplete (Partial)
- Type II – Branched groove
- Type III – Intersected groove
- Type IV – Reticular
- Type V – Other pattern

Super imposition 00:47:28

- A technique in identifying a person by superimposing the X-ray of the skull found after death, on the photo of the face of the suspected person.
- Super imposition was first used in Isabella Ruxton's case.

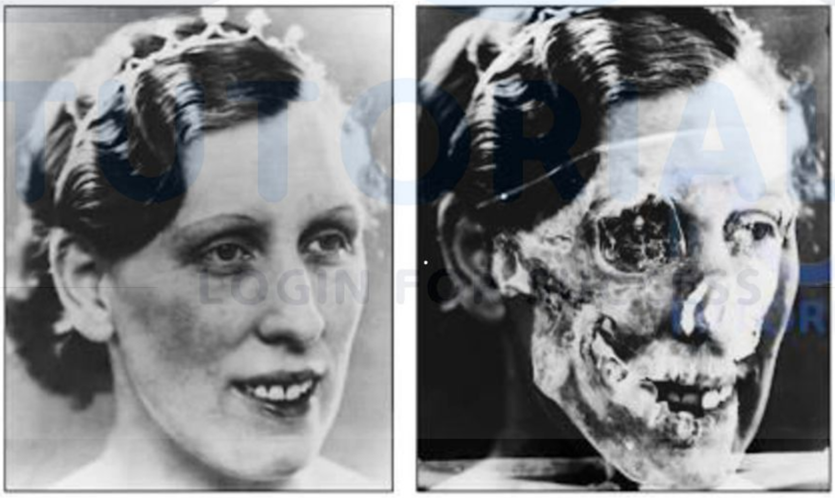


Fig: 27

- Skull super imposition is a technique in which the skull to be identified is super imposed on a life size photograph.
- The parameter used to enlarge the photo to life size for super imposition in Ruxton's case is tiara.

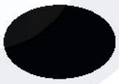
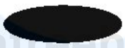
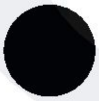
- It has got more negative value (Can rule out a person) than positive value (Can include many people).

Tattoo marks 00:50:40

- Dye's used for tattooing are
  - Black (Indian ink, carbon- soot)
  - Green: chromic acid
  - Red (cinnabar, Vermillion- mercuric sulphate)
  - Blue (Indian ink, China ink, Indigo, cobalt, Prussian blue, ultramarine)
- Gold/ platinum chloride (jet black stain) is used for corneal tattoo.
- The ideal depth for permanent tattoo is superficial layer of dermis.
- Faded tattoos are made visible by infrared rays.
- The ideal method to recognize latent tattoo in living is ultraviolet light.
- The ideal method to recognize latent tattoo in dead is regional lymph node biopsy (For the presence of pigments).
- Best method to remove the tattoo is LASER.
- Faint letter mark can be made visible by infrared photography.

Extra edge topics 00:54:18

Racial differences

Trait	Caucasoids	Negroids	Mongoloids
Prognathism	Least common	Common	Midway between
Orbits	Triangular	Square	Rounded
Nasal aperture	Narrow (Leptorrhine)	Broad (Platyrrhine)	Medium (Mesorrhine)
Nasal index (W/H x 100)	<70	>85	70-85
Palate	Triangular	Rectangular	Rounded/Horse shoe shaped
Hair on cross section	Oval 	Kidney/Elliptical 	Round 

Stature:

- When both side arms are outstretched in a straight line, the distance between the tips of the two middle fingers of the hands is approximately equal to the stature of the person.
- Symphysis pubis is the midpoint of the stature
- The distance between the sternal notch to the pubic symphysis is 1/3rd of the total height
- Stature is about 3.7 times the distance between the tip of olecranon and tip of middle finger of the same side

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- The height of the head measured by the vertical distance from the top of the head to the tip of the chin is about 1/7th of the total height
- And the length of the skull is about 1/8th of the total height
- The length of the vertebral column is 35/100 of the total height
- **Stature = FL/0.15 → Maximum foot length divided by 0.15 gives stature**
- **Variation in stature:**
- Stature or height of a person is maximum at 21-25 years
- Later, for every 25 years, it is shortened by 2.5 cm
  - Mainly due to thinning of intervertebral discs
- The height is maximum in the morning and less by 1.5 to 2cm in the evening
  - Due to reduction of elasticity of intervertebral discs
- In a dead body:
  - Soon after death due to primary relaxation of the muscles, the body length may be more by 2–2.5 cm
  - Later, when rigor mortis develops, it may be shortened
  - With the passage of rigor mortis and onset of putrefaction, the length may change due to secondary relaxation
- **Chronological order of appearance of hairs:**

  - Pubic Hair → Moustache → Beard → Axillary Hairs
- **Retinal scan**
  - The pattern of retina is unique and is not changed from birth to death.
  - The pattern is different even in identical twins
  - It is the most precise and reliable biometric
  - The pattern may be altered in cataracts, glaucoma, retinal degeneration and diabetes
- **Veins of the back of the hand**
  - There is complete individuality in the arrangement of the veins of the back of the hand
- **Scar**
  - Scars helps in
  - Identification of a person
  - Identification of causative weapon (by the shape)
  - Previous pregnancy etc.
- Disfiguration due to scars amounts to grievous hurt

Medico-Legal Importance of Age 5 Years

- Custody of minor who has not completed the age of 5 years shall ordinarily rest with the mother

7 years

- A child below 7 years of age is exempted from criminal liability because he is incapable of having a criminal intent (82 I.P.C.)

7-12 years

- A child between the age of 7 and 12 years may/may not be held liable for any criminal act. It depends on whether the child had attained the proper mental maturity to understand the nature and consequences of the act at that time (83 I.P.C.)

10 years

- Taking away a child below the age of 10 years with intention of robbing any moveable property from the person/body of such a child amount to kidnapping (369 I.P.C.).

12 years

- A child under 12 years cannot give valid consent to suffer any harm that may result from any act done in good faith for the benefit of the child
  - That means a child under 12 years cannot give valid consent even for general physical examination
  - Consent of guardian or the person having lawful charge of the child is required (89 I.P.C.)
- Consent given by a person who by reason of immaturity of age (i.e., a child below 12 years) is incapable of understanding nature and consequences of the act is not valid in the eyes of law (90 I.P.C.)

12 years

- A child below the age of 12 years need not to take oath
- Exposure and abandonment of a child below 12 years of age by the parent or the person having care of the child is punishable (317 I.P.C.)

- As per Indian Railway's Act, if a person under the age of 12 years is guilty of any of the offences under this Act, he is not punishable
    - The father or guardian of such person to execute a bond for such amount and for such period for the good conduct of such person

14 years

- A child less than 14 years cannot be employed in a factory

14-15 years

- Between 14 and 15 years of age, a person can be engaged in non-hazardous factory jobs for a limited period during day hours

15 years

- Above 15 years of age, one can be employed in a factory like an adult subject to the production of fitness certificate for the particular employment
- A police officer cannot compel attendance of a male person below 15 years (or any woman) at any place other than the place in which such male person (or woman) resides (160 Cr.P.C.)

15 years

- A decree of divorce can be procured by the wife if her marriage (whether consummated or not) had been solemnized before she attained the age of 15 years, and she repudiates the marriage after attaining that age but before attaining the age of 18 years

→ Section 13(2) (IV) of Hindu Marriage Act (HMA)

16 years

- Taking away a male under 16 years of age without the consent of parent/legal guardian amounts to Kidnapping (361 I.P.C.)

17 years

- A candidate seeking admission to MBBS course must complete the age of 17 years on or before 31st of December of the year of admission (MCI regulation on graduate medical education)

15-18 years

- In case, husband has sexual intercourse with his wife aged between 15- and 18-years and if the wife lodges a complaint within 1 year, it amounts to rape

16-18 years

- A person below the age of 18 years is called as 'Juvenile'
- Maximum imprisonment for a juvenile offender is 3 years
- But if the age of the juvenile offender is between 16 and 18 years and involved in a heinous crime, then he will be tried as an adult and more than 3 years imprisonment can be given, but death sentence and life imprisonment cannot be passed

18 years

- Sexual intercourse with a girl below 18 years of age even with her consent amounts to rape (Statutory rape) → 375 I.P.C.
- Qualifying age of marriage for females (Planning to change to 21)
- One becomes 'major'
- Pregnant woman can give consent for termination of pregnancy under MTP Act
- A person under 18 years of age cannot give valid consent to suffer any harm that may result from an act not intended or not known to cause death or grievous hurt, e.g., consent for an operation (87 IPC)
  - Consent for operation can be given only after 18 years of age
- Can give consent for removal of organ from his/her body for therapeutic purposes (Transplantation of Human Organs Act)

18 years

- Procuration of a girl aged less than 18 years for illicit intercourse amounts to kidnapping (366-A IPC)
- Right to cast vote
- A person having a sound disposing mind can make a 'valid will'
- Taking away a female under 18 years of age without the consent of parent/legal guardian amounts to Kidnapping (361 I.P.C.)
- Can hold a driving license

- Can work in a hazardous factory
- Can get government job

20 years

- A person selling, letting to hire, distributing, exhibiting or circulating obscene objects to any person under 20 years of age is punishable (293 I.P.C.).

21 years

- Qualifying age of marriage for males
- Importing a girl from a foreign country aged less than 21 years for illicit intercourse amounts to kidnapping 366-B IPC
- Those under guardianship of court attains majority

25 years

- Minimum age for contesting for the membership for the parliament/other legislative bodies
- Can become Prime minister of India above 25 years of age if they are a member of the Lok Sabha

30 years

- Can become Prime minister of India above 30 years of age if they are a member of the Rajya Sabha

35 years

- Minimum age for appointment as the President/Vice President of India and Governor of a State

- No prenatal diagnostic technique shall be used or conducted unless the age of pregnant woman is above 35 years (PC and PNDT Act)

55-70 years

- Age for retirement from service under some government, statutory, or autonomous bodies
- NMC allows a medical teacher to work in a medical college till completion of 70 years of age

Developmental Changes in A foetus

- **1 Month** → Length: 1 cm. Weight: Two and half gram. Eyes are indicated by two dark spots, mouth as cleft, beginning of limb bud like process
- **2 Months** → Length: 2.54 cm, Weight: 10 grams. Mouth and nose are separated, anus appears as a dark spot, placenta commenced to form, feet and hand webbed
- **3 Months** → Length: 9 cm. Weight: 30 grams. Placenta is developed, head is rounded, larger than trunk (head constitutes approximately half of the crown-rump length of fetus) becomes more human looking, separated by appearance of neck, heart four chambered, limbs, fingers and toes well developed but nail remains in membranous form. The alimentary tract is situated in abdominal cavity
- **4 Months** → Length: 16 cm. Weight: 120 grams.
  - The sex can be differentiated. Skin covered by appearing downy lanugo hairs.
  - Skin is rosy and firmer; the head is one-fourth of the length of body.

  - Umbilicus is situated near the pubic symphysis.
  - Brain convolutions begin to appear.
  - Gall bladder is formed, and meconium is found in duodenum.
  - Pupillary membrane appears.
  - The fetus can be detected on X-ray.
- **5 Months** → Length: 25 cm. Weight: 400 grams.
  - Light hairs appear at scalp, the head is larger and about 1/3rd of crown-rump length of fetus.
  - Lanugo distinct, nails are distinct and soft, the position of umbilicus recedes upwards, skin covered with vernix caseosa.
  - Bile begins to form, meconium found in beginning of colon (ascending colon)
- **6 Months** → Length: 30 cm. Weight: 700 grams
  - The skin is red and wrinkled appearance and subcutaneous fat begins to be deposited.
  - Vernix caseosa is present.
  - Meconium present in transverse colon and testis are seen near kidneys
- **7 Months** → **Length: 35 cm. Crown -rump length: 23 cm, Foot length: 8 cm, Weight: 900-1200 gram.**
  - Nails are thick. Skin is dusky red, thick and fibrous.
  - Eyelids open and Pupillary membrane disappeared.
  - Meconium in descending colon.
  - Testes are found at external inguinal ring
- **8 Months** → Length: 40 cm, Weight: 1.5 to 2 Kg.

- The skin is rosy, not wrinkled, covered with soft hairs. Lanugo has disappeared from face, and the hairs of scalp are denser and longer (1.5 cm).
- **The nails reach up to tip of fingers** but not up to tip of toes.
- Left testis is in scrotum. Right testis near the external inguinal ring. Scrotum corrugated.
- Meconium reaches up to rectum.

- **9 Months** → Length: 45 cm, Weight: 2.2 to 3 Kg. Placenta: 500 gm.
  - Scalp hairs longer and is about 2-4 cm, lanugo has disappeared from body except on shoulder, vernix found in flexures of joints.
  - Nail grows beyond the tips of fingers and up to tip of toes.
  - Both testes in scrotum. Meconium found in rectum.
- **10 Months**
  - Length: 48-52 cm, Crown-rump length: 28 - 32 cm, Weight: 2.5 to 4 Kg.
  - Head circumference: 33-38 cm. Scalp covered with 3-5 cm hairs, lanugo absent from body except at shoulders, face not wrinkled, skin pale and covered with vernix caseosa.
  - Umbilicus is mid-way between pubis symphysis and xiphisternum.
  - Nails projected beyond tips. The rectum contains meconium. Vulva closed; labia major cover labia minora and clitoris.

IDENTIFICATION PART –II

Dentition 00:00:17

- There are 2 sets of teeth
  - Temporary/Deciduous/Primary/Milky teeth
  - Permanent/Secondary

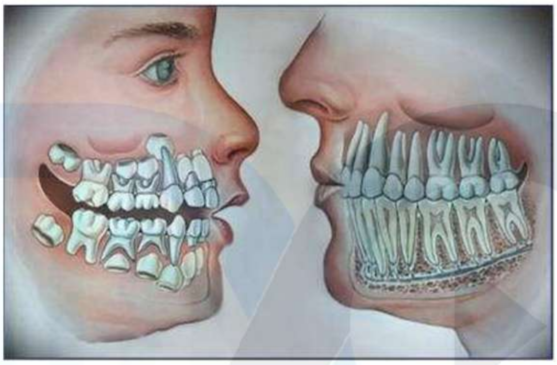


Fig: 1

Temporary teeth 00:00:39

- From medial lateral

  1.Central incisor

  2.Lateral incisor

  3.Canine

  4.1st molar

  5.2nd molar

- Total no. of teeth → 5x4 (Quadrants) = 20

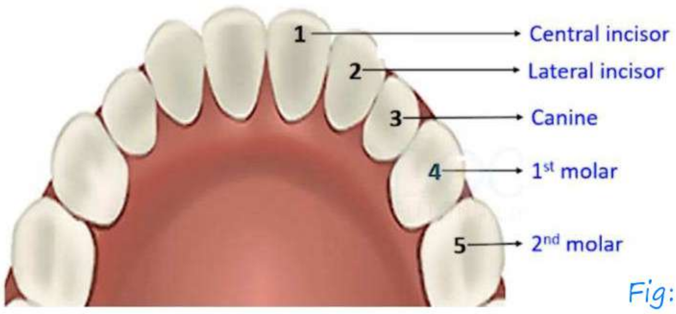

1
2
3
4
5
Central incisor
Lateral incisor
Canine
1st molar
2nd molar

Fig: 2

Eruption of temporary teeth 00:01:51

- Lower central incisors → 6-8months
- Upper central incisors → 7-9months
- Upper lateral incisors → 7-9months
- Lower lateral incisors → 10-12months

  1yr → 8 teeth
- 1st molar → 12-14months
- Canine → 17 – 18 months

  1 ½ years → 16 teeth
- 2nd molar → 20-30 months → 2.5 years → 20 teeth
- Teeth erupt earlier in lower jaw; Exception: Lateral incisor
  - Early tooth eruption is seen in syphilis.
- Delayed eruption of teeth is considered when there are no teeth at the age of 13 months.
- Commonest cause for delayed tooth eruption is hypothyroidism.
- Causes for delayed tooth eruption are:
  - Hypothyroidism
  - Hypopituitarism
  - Rickets
  - Downs syndrome
  - Cleido-cranial dysplasia
  - Cysts and supernumerary teeth

Permanent teeth 00:06:51

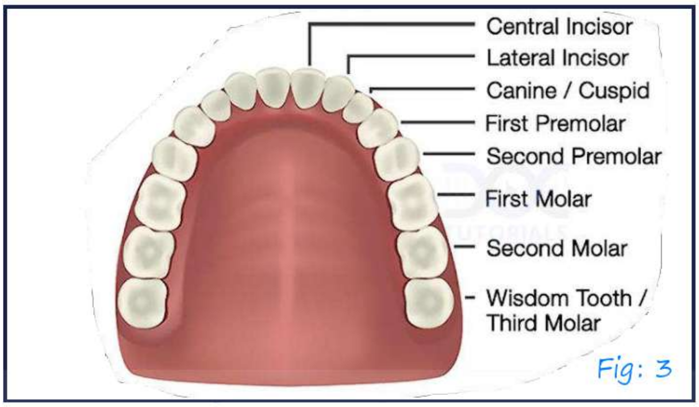
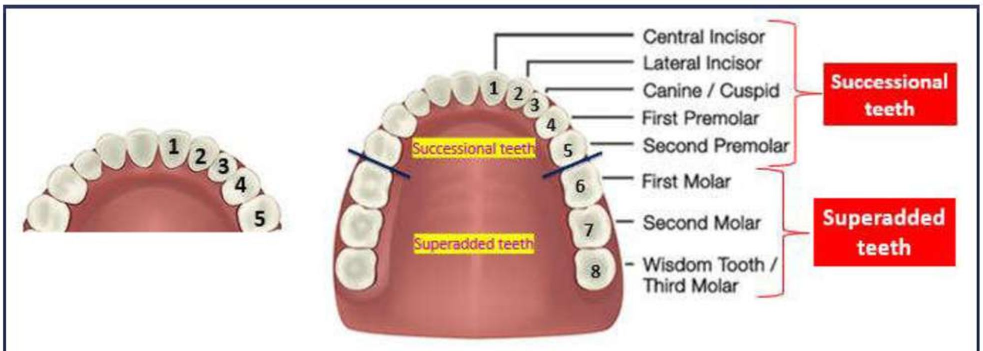

Central Incisor
Lateral Incisor
Canine / Cuspid
First Premolar
Second Premolar
First Molar
Second Molar
Wisdom Tooth / Third Molar

Fig: 3

- Antigravity molars (Upper) have 3roots and the lower molars have 2 roots

Successional & super added teeth 00:08:06

- Successional teeth → Teeth erupt in place of deciduous teeth
- Superadded teeth → Which do not erupt in place of deciduous teeth
- Total number of superadded teeth in each jaw is 6
- Common location of supernumerary teeth is upper incisor


1
2
3
4
5
Successional teeth
Superadded teeth
1
2
3
4
5
6
7
8
Central Incisor
Lateral Incisor
Canine / Cuspid
First Premolar
Second Premolar
First Molar
Second Molar
Wisdom Tooth / Third Molar
Successional teeth
Superadded teeth

Successional teeth
↓
Which erupt in place of deciduous teeth

Superadded teeth
↓
Which do not erupt in place of deciduous teeth

Fig: 4

Eruption of permanent teeth 00:10:41

1st M	CL	LI	1ST BI	2nd BI	Canine	2nd M	3rd M
M	I	I	B	B	C	M	M
Mummy	Is	In	Bed	Baby	Cries	Milk	Milk
6	7	8	9	10	11	12	18-25

- Best method of determination of age up to 12yrs is dentition.
- Space for last molar
  - The lengthening of the ramus of the mandible behind second molar which take place between the time of eruption of 2nd and 3rd molars.

Age in years	Permanent teeth	Temporary teeth	Total teeth
2 ½ - 5	0	20	20
6	4	20	24
7	8	16	24
8	12	12	24
9	16	8	24
10	20	4	24
11	24	0	24
12	28	0	28

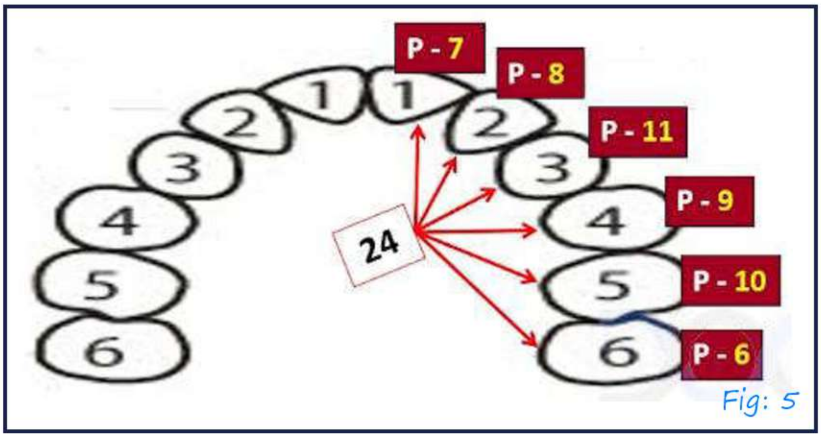


Fig: 5

- Total number of teeth during mixed dentition → 24
- Period of mixed dentition is between the age of 6 & 11 years
- Formula for calculation of Number of Permanent and temporary teeth:

• Permanent teeth = (Age – 5) x 4

• Temporary teeth = 24 – Permanent teeth

  - E.g., In a 9yrs old child

• Permanent teeth = (9 – 5) x 4 = 16

• Temporary teeth = 24 – 16 = 8

Dental formulae 00:23:58

- Mouth is divided into 4 quadrants, namely: Upper right, upper left, lower right, and lower left

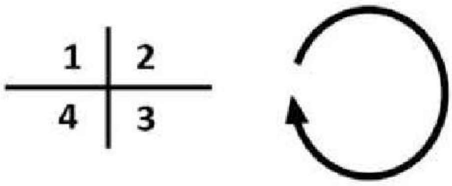
UR	UL
LR	LL

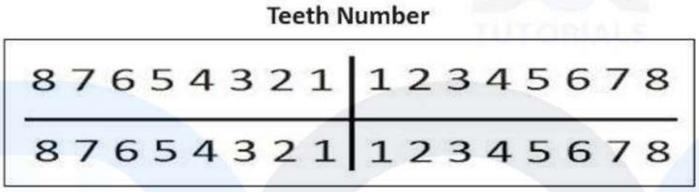
FDI formula 00:24:20

French Dentaire Internationale (FDI) formula

Permanent teeth:

Quadrants are numbered



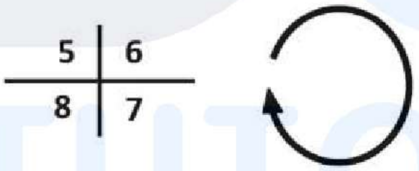


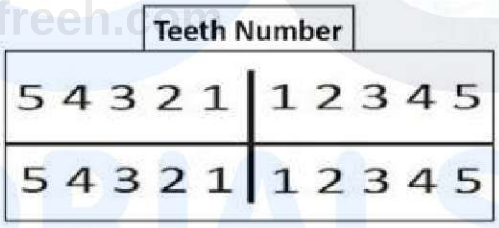
Teeth Number

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

Temporary teeth:

- Quadrants are numbered

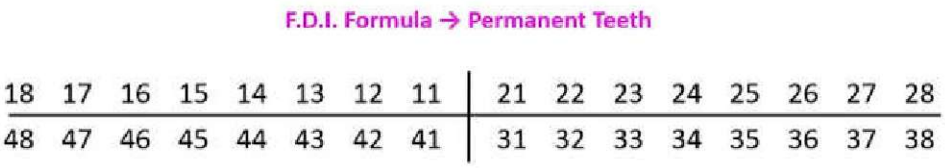




Teeth Number

5	4	3	2	1	1	2	3	4	5
5	4	3	2	1	1	2	3	4	5

- Teeth are numbered by writing: Quadrant no. followed by tooth no



F.D.I. Formula → Permanent Teeth

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

- FDI formula → Temporary teeth

55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75

MFDI formula 00:28:08

Permanent teeth

- Quadrants are numbered

1	2
3	4

Teeth Number

8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Temporary teeth

- Quadrants are numbered

5	6
7	8

Teeth Number

5 4 3 2 1	1 2 3 4 5
5 4 3 2 1	1 2 3 4 5

- Teeth are numbered by writing: Quadrant no. followed by tooth no.
- Eg: MFDI formula → Permanent teeth

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
38	37	36	35	34	33	32	31	41	42	43	44	45	46	47	48

- MFDI formula → Temporary teeth

55	54	53	52	51	61	62	63	64	65
75	74	73	72	71	81	82	83	84	85

Palmer's notation 00:30:04

- Permanent teeth (They are numbered 1-8)

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

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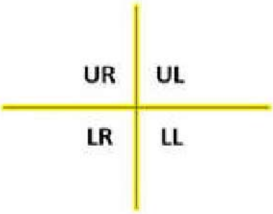
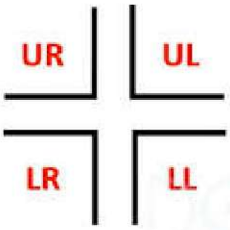
- Temporary teeth (Denated as English capital alphabets)

E	D	C	B	A	A	B	C	D	E
E	D	C	B	A	A	B	C	D	E

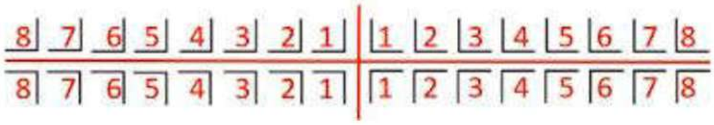
- Write the tooth number inside the quadrant shape





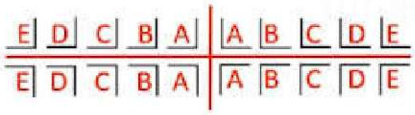
Palmer's notation:

- Permanent teeth



8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

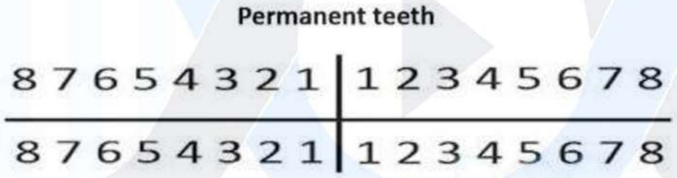
- Temporary teeth



E	D	C	B	A	A	B	C	D	E
E	D	C	B	A	A	B	C	D	E

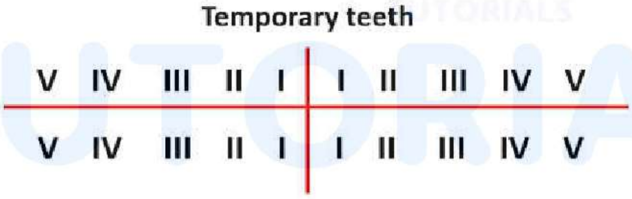
Zygmondi's method 00:32:18

- It is same as Palmer's notation, but Roman numbers are used for temporary teeth.



Permanent teeth

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

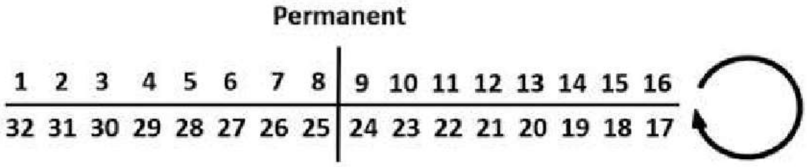


Temporary teeth

V	IV	III	II	I	I	II	III	IV	V
V	IV	III	II	I	I	II	III	IV	V

Universal system 00:33:04

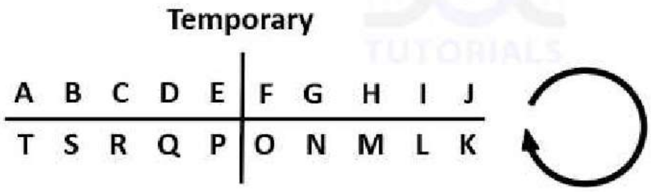
- It is widely used in USA.
- Permanent teeth (Clockwise)



Permanent

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

- Temporary teeth



Temporary

A	B	C	D	E	F	G	H	I	J
T	S	R	Q	P	O	N	M	L	K

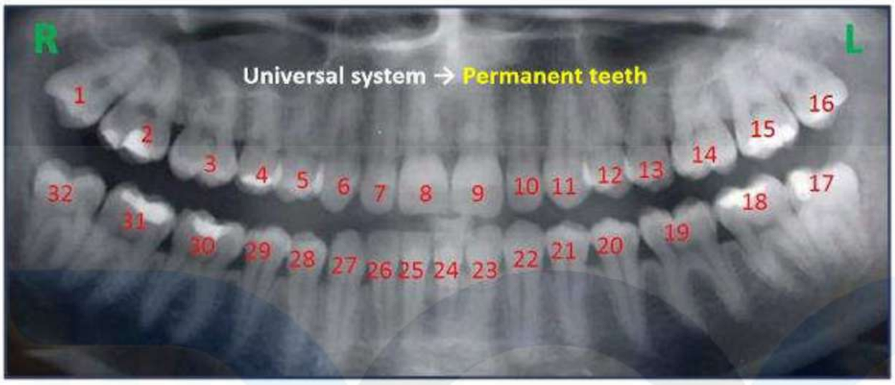
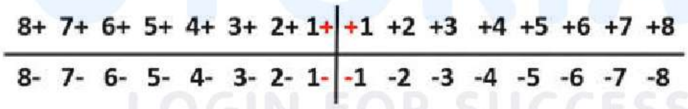

R
L
Universal system → Permanent teeth
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17

Fig: 6

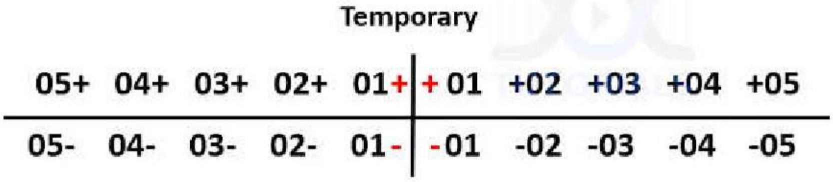
Haderup system 00:34:51

- Upper quadrant is denoted by '+' & lower quadrant is denote by '-'
- Permanent teeth



8+	7+	6+	5+	4+	3+	2+	1+	+1	+2	+3	+4	+5	+6	+7	+8
8-	7-	6-	5-	4-	3-	2-	1-	-1	-2	-3	-4	-5	-6	-7	-8

- Temporary teeth



Temporary

05+	04+	03+	02+	01+	+01	+02	+03	+04	+05
05-	04-	03-	02-	01-	-01	-02	-03	-04	-05

Gustafson's method 00:38:35

- It is used determine age of a person between 25 & 60years by secondary changes in teeth
- Anterior teeth are preferred over post teeth (best is central incisor)
- 6 criteria are used

  1.**Attrition** → Wear & tear

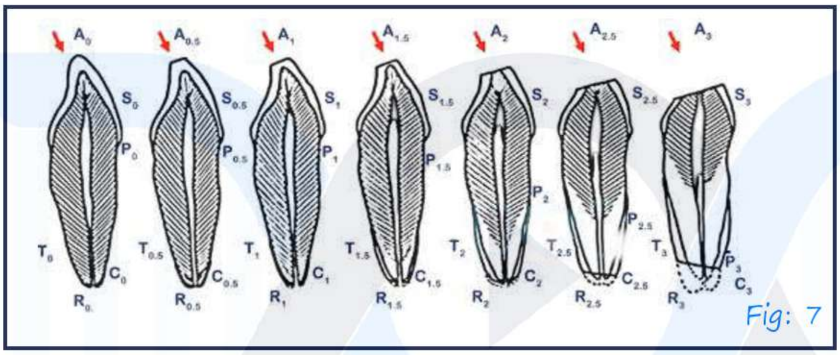

A_0
$A_{0.5}$
A_1
$A_{1.5}$
A_2
$A_{2.5}$
A_3
S_0
$S_{0.5}$
S_1
$S_{1.5}$
S_2
$S_{2.5}$
S_3
P_0
$P_{0.5}$
P_1
$P_{1.5}$
P_2
$P_{2.5}$
P_3
T_0
$T_{0.5}$
T_1
$T_{1.5}$
T_2
$T_{2.5}$
T_3
C_0
$C_{0.5}$
C_1
$C_{1.5}$
C_2
$C_{2.5}$
C_3
R_0
$R_{0.5}$
R_1
$R_{1.5}$
R_2
$R_{2.5}$
R_3

Fig: 7

  2.**Periodontitis** → Loosening of the teeth

  – Must be assessed before extraction

  3.**Secondary dentin formation**

  – 2nd best criterion

  4.**Root resorption**

  – Least reliable & most difficult to recognize & assay.

  5.**Transparency to root**

  – Most reliable criterion

  6.**Cementum opposition**

  Mnemonic: **APSRTC**

- Arbitrarily, 0 to 3 points are allotted to indicate the degree of any of these changes

  - Stage 0 indicates no change
  - Stage 1 indicates beginning of change
  - Stage 2 indicates obvious change
  - Stage 3 indicates maximum change, occurring in the dental tissue
- Total score points = $A_n + P_n + S_n + C_n + R_n + T_n$
- Estimated age (years) =11.43 + 4.56 X (total points) +/- 3.36 years
- The error is said to be +/- 4 to 7 years
- Some adjustment in the final calculation may be done in case of people with bad oral hygiene
- The limit of error increases above 50 years of age
- All changes are absent at 15 years
- Translucency is seen after 30 years of age

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DOCTUTORIALS
LOGIN FOR SUCCESS

Age estimation by teeth 00:45:23

- Mile's method
  - Uses only one criterion i.e., Root transparency
  - Helpful after 30 years of age
- Lamendil's method
  - Uses two criteria
  - Gingival recession (Periodontosis) and Root transparency of tooth.
- Stack's method
  - By measuring the weight & height of erupting teeth of child.

- Boyde's method
  - It is estimation of incrementary lines in the teeth.
- In a charred body comparison of post-mortem X-rays with dental records is a useful means of establishing identity

Extra edge topics 00:48:30

- Complete root calcification occurs at about 1-1½ years after the eruption of teeth.
- Calcification of first molar begins at birth and calcification of third molar at 8-10 years.
- The number and eruption of deciduous teeth is more regular than the permanent dentition.
- Eruption is not always bilaterally symmetrical.
- Mandibular canine index can determine the sex of a person and
  - The accuracy of this method is reported to be 85%.
- Tooth eruption in female may be one year before that of males.
- Ossification centres fuse about one year earlier in females.
- Cranial sutures close later in females than males.

IDENTIFICATION PART –III (BONES)

- Number of ossification center at 8th week of intrauterine life (IUL) are 806.
- At birth 450
- Adults will have 206 bones
- Comingling (Mixing) of bones of two individuals is best separated by short-wave ultraviolet rays.

Race from bones 00:01:10

- Indices to differentiate race
  - Brachial index (Radio–humeral index)
  - Crural index (Tibio–femoral index)
  - Intra–membral index (Humero-femoral index)
  - Inter membral index
  - Cephalic index

Cephalic index 00:02:10

- It is used for the determination of race from skull.
- $$\frac{\text{Max breath of the skull}}{\text{Max length of the skull}} \times 100$$
  - Dolichocephalic (Long headed) → 70-75 → Africans & Pure Aryans

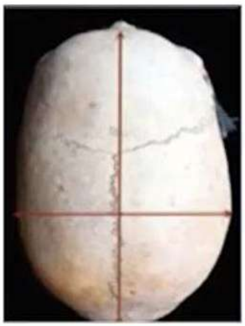


Fig: 1

- Mesaticephalic (Med long headed) → 75-80 → Indians, Europeans, Chinese

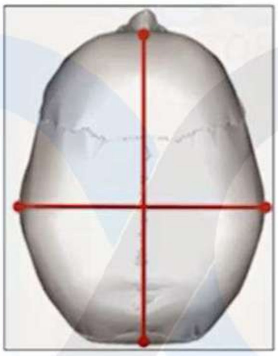


Fig: 2

- Brachycephalic (Round headed) → >80 → Mongolians

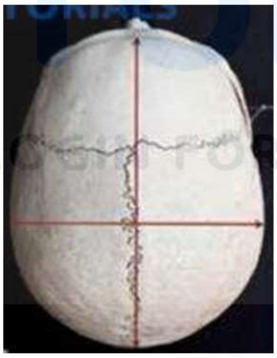


Fig: 3

Craniosynostosis 00:04:54

Due to premature closure of sutures

- Scaphocephaly → Premature closure of sagittal suture

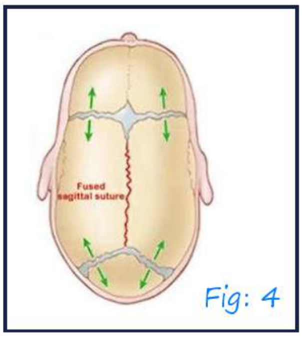

Fused sagittal suture

Fig: 4

- Brachycephaly → Premature closure of coronal suture

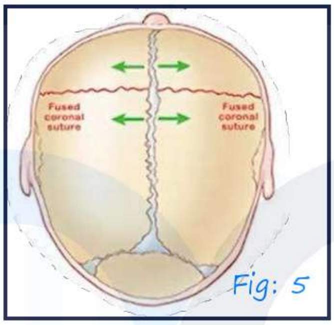

Fused coronal suture
Fused coronal suture

Fig: 5

- Trigonocephaly → Premature closure of metopic suture

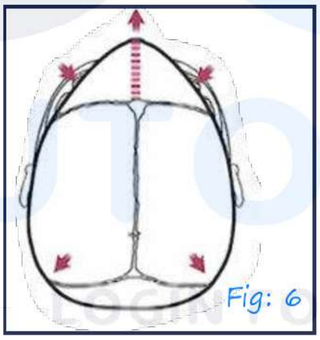


Fig: 6

- Plagiocephaly → Premature closure of unilateral coronal or lambdoid

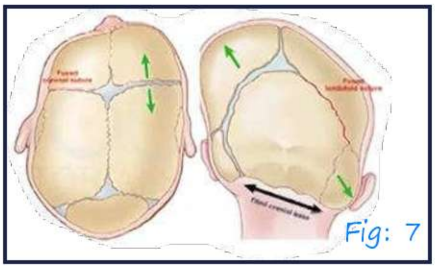

Fused coronal suture
Fused lambdoid suture
Fixed cranial base

Fig: 7

Sex from bones 00:06:45

- Indices to differentiate sex from bones
  - Sternal index
  - Ischio–pubic index (Washburn index)
  - Sciatic notch index → Best criterion in pelvis to determine sex.
  - Sacral index
  - Corporo-basal index → Only index which is more in males

$$\frac{\text{Breadth of the first sacral vertebra}}{\text{Breath of base of sacrum}} \times 100$$

  - Only index, which is more in males
  - Medullary index (MI)
  - Ideal bones for MI are: Humerus, Ulna, Radius & Tibia (HURT)

Chilotic line 00:10:56

- It helps differentiate the sex of a person
- Anthropometric line extending from the posterior aspect of iliopectineal eminence(A) to the closest point on the anterior auricular margin(B) (The pelvic segment) and then to the iliac crest (The sacral portion) (C).

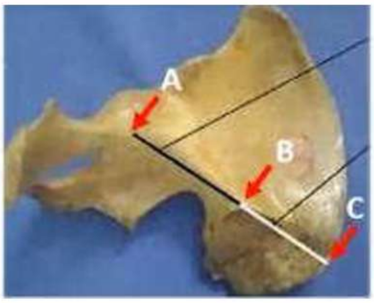


Fig: 8

- In males → Sacral part is prominent s
- In females → Pelvic part is prominent

Percentage of accuracy of sex determination from bones:

Entire skeleton	100%
Pelvis alone	95%
Skull alone	90%
Pelvis + Skull	98%
Long bones alone	80%
Skull + long bones	95%
Pelvis + Long bones	98%

- The most reliable single bone for sex determination is pelvis.
- Sex differentiation from bones can be done only after puberty, but sex can be differentiated by the greater sciatic notch even in fetus.

How to differentiate sex from bones 00:16:07

- Supra orbital ridge
  - Male → More prominent
  - Female → Less prominent

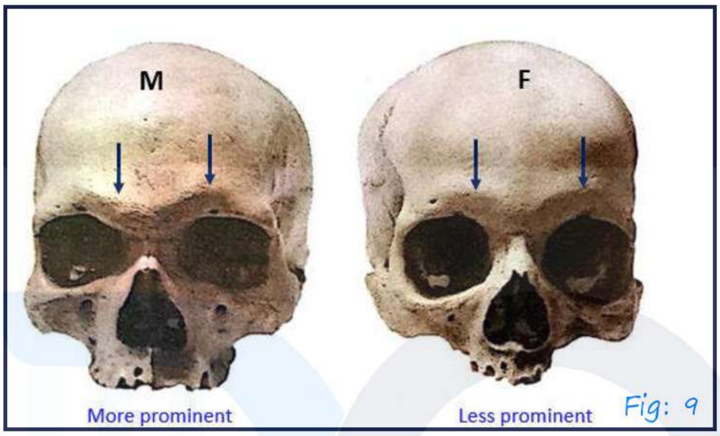

M
F
More prominent
Less prominent

Fig: 9

- Glabella
  - Male → More prominent
  - Female → not prominent

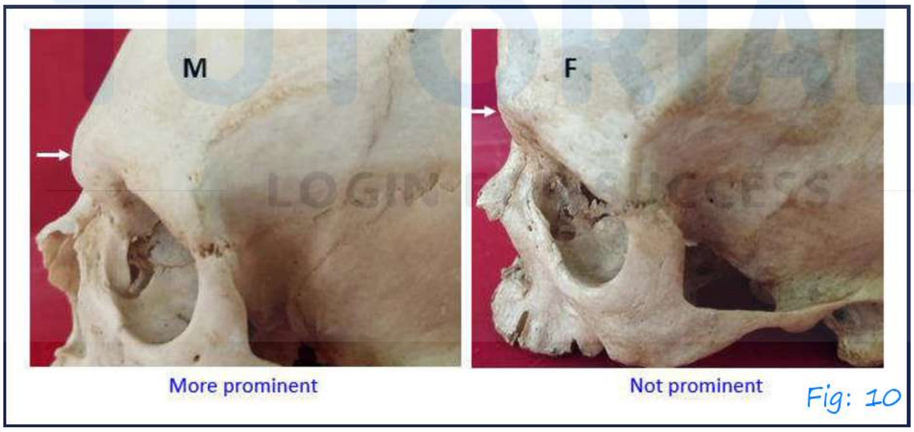

M
F
More prominent
Not prominent

Fig: 10

- Frontonasal angle
  - Male → Distinct
  - Female → Not distinct

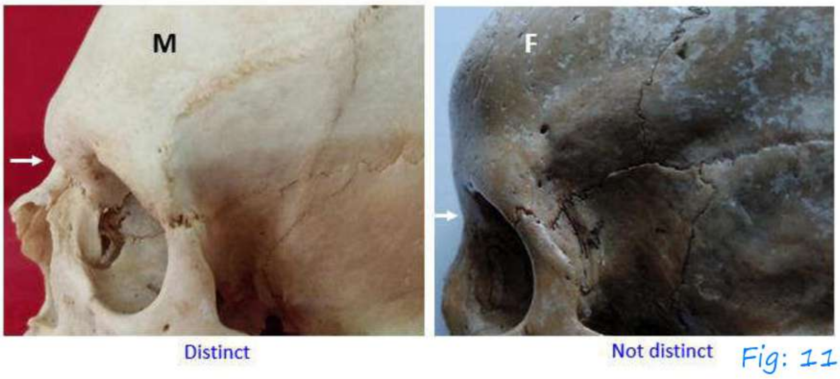

M
F
Distinct
Not distinct

Fig: 11

- Mastoid process
  - Male → More prominent
  - Female → Less prominent

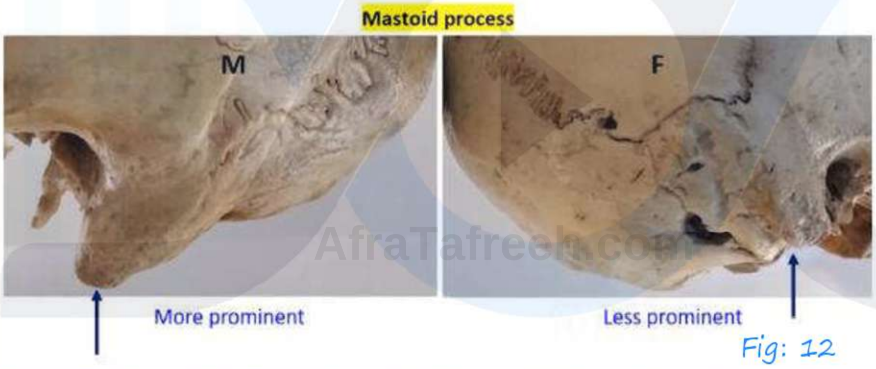

Mastoid process
M
F
More prominent
Less prominent

Fig: 12

- Muscular markings
  - Male → Well marked
  - Female → Not well marked

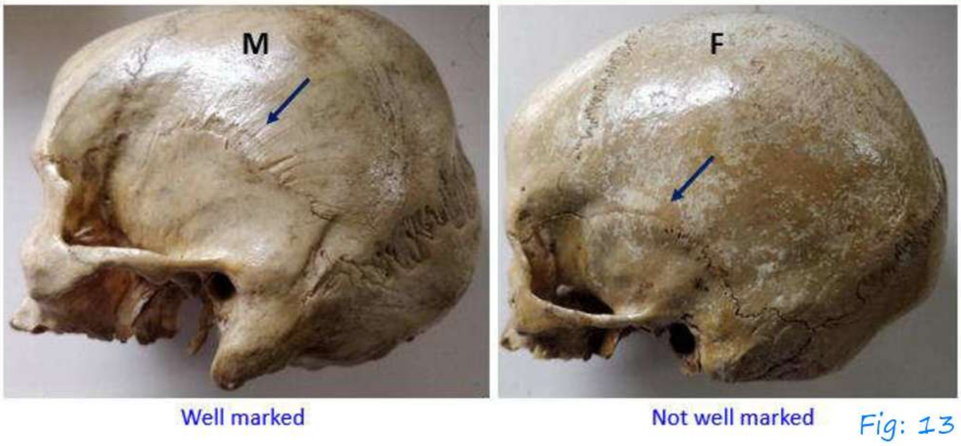

M
F
Well marked
Not well marked

Fig: 13

- Frontal & parietal eminences
  - Male → Not/less prominent
  - Female → Prominent

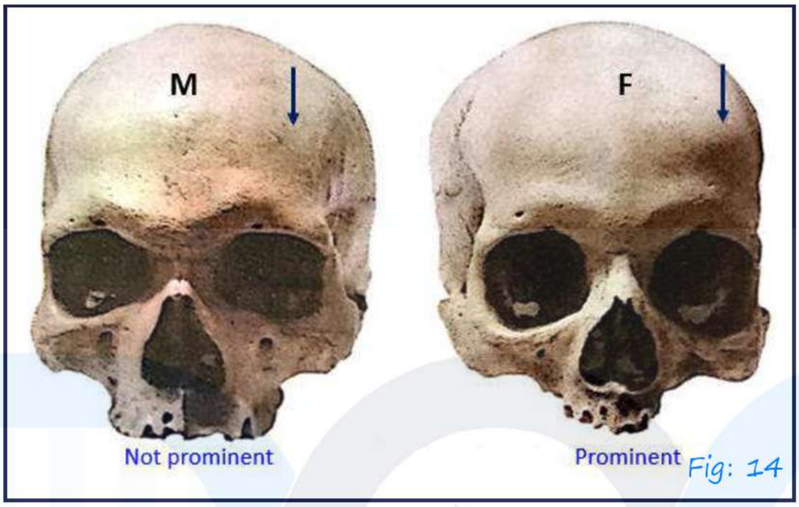

M
F
Not prominent
Prominent

Fig: 14

- Orbit
  - Male → Square
  - Female → Rounded

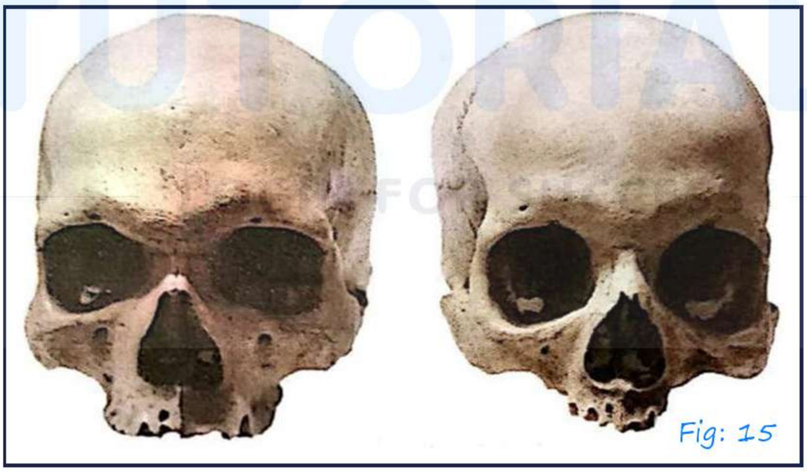


Fig: 15

DIFFERENCE BETWEEN MALE AND FEMALE CRANIUM

Male	Female
Larger and heavier	Smaller and lighter
Cranial capacity → 1450-1550cc	Cranial capacity → 1300-1350cc
Forehead → Sloping	Forehead → Vertical
Glabella, supra-orbital ridges, mastoid process, occipital protuberance, occipital condyles and muscular attachments → More pronounced	Glabella, supra-orbital ridges, mastoid process, occipital protuberance, occipital condyles and muscular attachments → Less pronounced
Fronto-nasal angulation → Distinct	Fronto-nasal angulation → Not well marked
Frontal & parietal eminences → Less prominent	Frontal & parietal eminences → More prominent
Orbital opening → Comparatively big and rectangular	Orbital opening → Comparatively small and rounded

Difference between male & female mandible

00:21:50

DIFFERENCE BETWEEN MALE AND FEMALE MANDIBLE

Male	Female
Generally heavier	Generally lighter
Angle → Closer to 90°	Angle → Greater, up to 110° -120°
Chin → Square/'U' shaped	Chin → Pointed or rounded
Angle region → Everted	Angle region → Not everted
Symphyseal height → More	Symphyseal height→ Less
Ramus → Broader	Ramus → Less broad
Mental tubercle is → More pronounced	Mental tubercle → Less pronounced

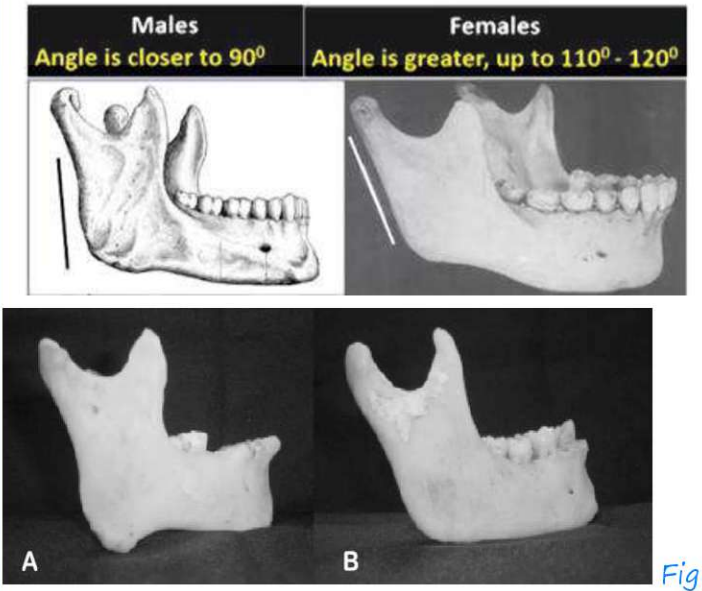

Males
Angle is closer to 90⁰
Females
Angle is greater, up to 110⁰ - 120⁰
A
B

Fig: 16

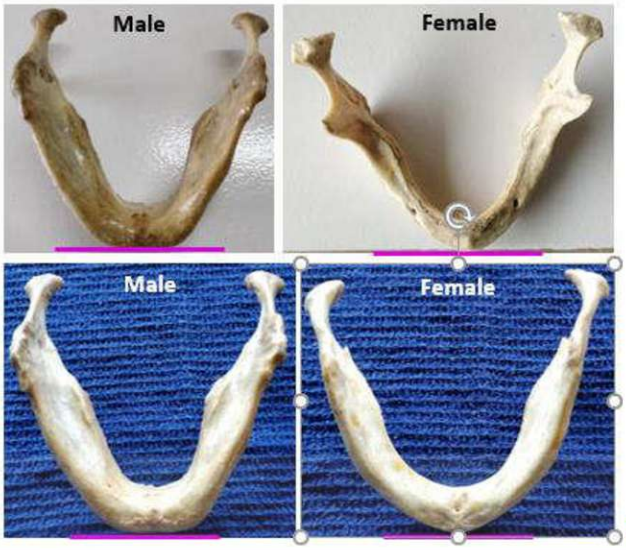

Male
Female
Male
Female

Fig: 17

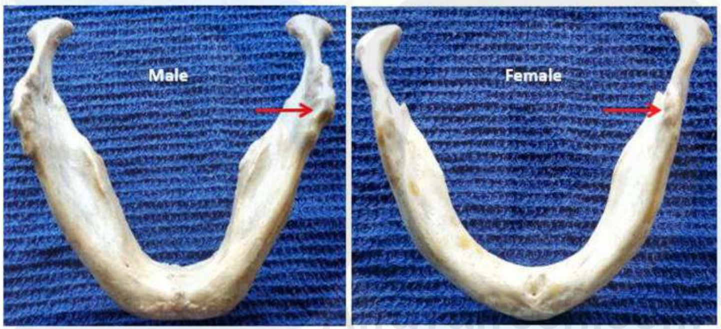

Male
Female

Fig: 18

DOCI TUTORIALS
LOGIN FOR SUCCESS

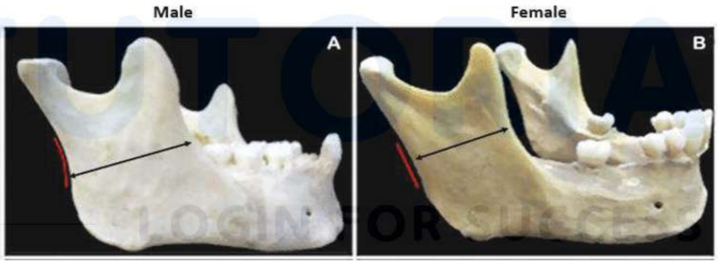

Male
Female
A
B

Fig: 19

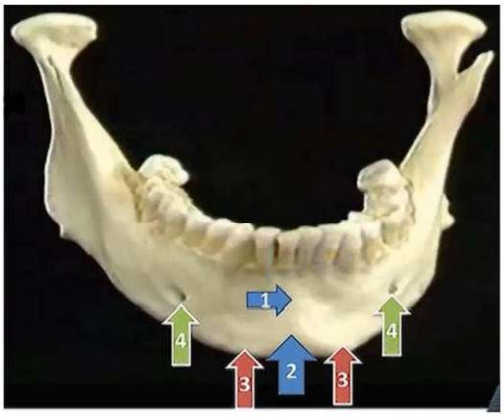


Fig: 20

- Sup-pubic angle
  - Male: 70° – 75° V shaped
  - Female: 90° – 100° U shaped

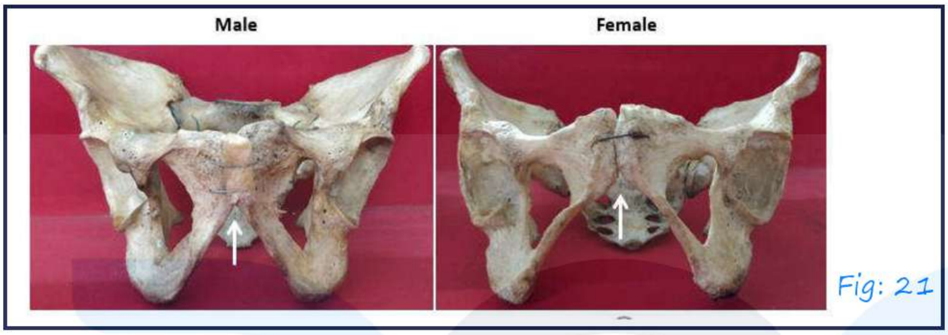

Male
Female

Fig: 21

- Greater sciatic notch
  - Males: Narrow & deep
  - Females: Wide & shallow

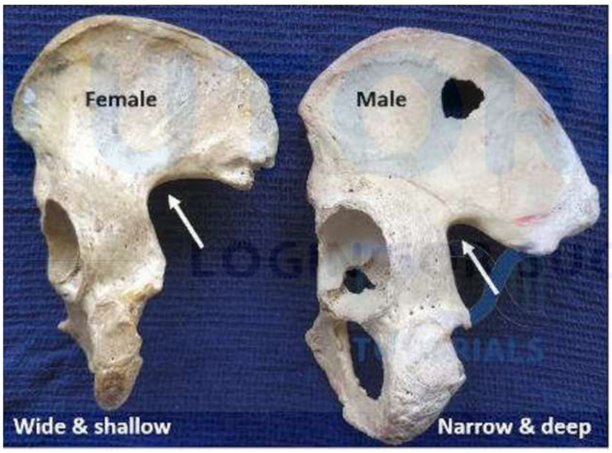
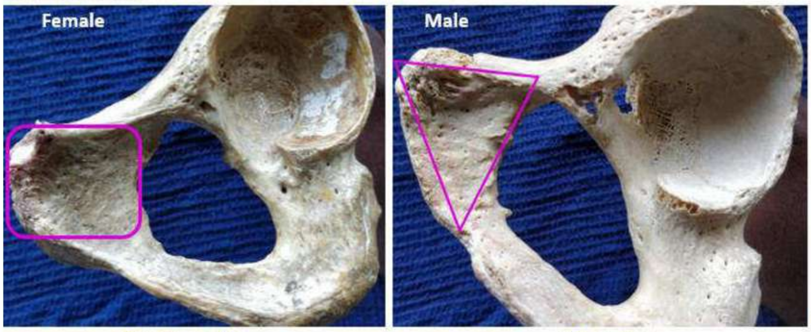

Female
Male
Wide & shallow
Narrow & deep

Fig: 22

- Body of pubis
  - Male: Triangular
  - Females: Quadrangular

BODY OF PUBIS



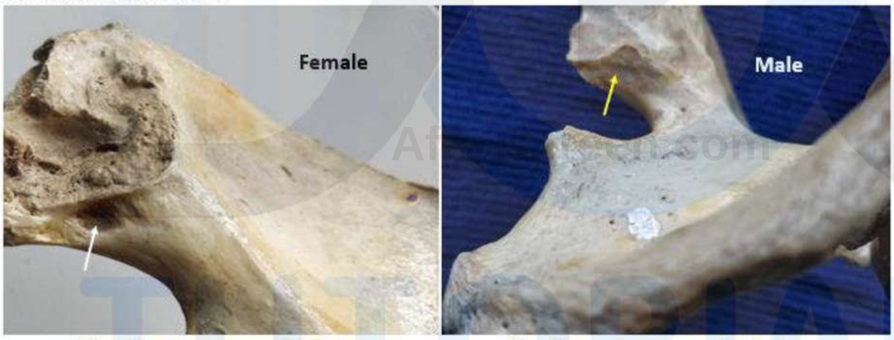
Quadrangular

Triangular

Fig: 23

- Preauricular sulcus (PAS)
  - Male: Not frequent; narrow & shallow
  - Female: More frequent: Broad & deep

PREAURICULAR SULCUS



More frequent; broad & deep

Not frequent; narrow & shallow

Fig: 24

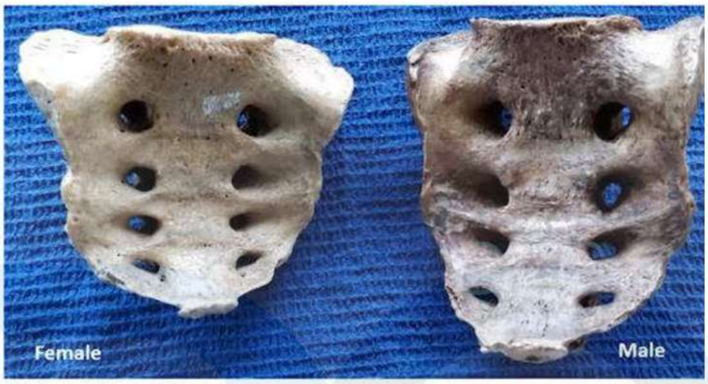
  - PAS is tertiary sexual characteristic.
- Obturator foramen
  - Male: large and oval
  - Female: small and triangular

DIFFERENCE BETWEEN MALE AND FEMALE PELVIS

Male	Female
Body → Massive, rough, prominent muscular markings	Body → Less massive, smooth, muscular markings not prominent
Inlet → Deep funnel with heart shaped	Inlet → Flat bowl, circular/elliptical
Subpubic arch → Narrow, 'V' shaped (70 to 75°)	Subpubic arch → Wide, 'U' shaped (90 to 100°)
Greater sciatic notch → Narrow, deep and less than right angle	Greater sciatic notch → Wide, shallow and almost a right angle or even more
Body of the pubis → Triangular	Body of the pubis → Square
Preauricular sulcus → Narrow, shallow and without marked edges	Preauricular sulcus → Broad and deep in parous women
Obturator foramen → Large and oval	Obturator foramen → Small and triangular
Ischial tuberosities → Inverted	Ischial tuberosities → Everted

Sacrum 00:36:13

- Body
  - Females → wide and short
  - Males → Long & narrow



Shorter & broader Longer & narrower

Fig: 25

- Sacral promontory:
  - Males: prominent
  - Females: not prominent

DIFFERENCE BETWEEN MALE AND FEMALE SACRUM	
Male	**Female**
Body → Long and narrow	Body → Wide and short
Sacral promontory → Prominent	Sacral promontory → Not prominent
Auricular surface of the sacrum → Extends 2.5 to 3 vertebral bodies	Auricular surface of the sacrum → Extends 2 to 2.5 vertebral bodies

Curvature → More evenly distributed	Curvature → Upper half almost straight, curve forward in lower half;
Breadth of body of 1st sacral vertebra → More than breadth of one ala	Breadth of body of 1st sacral vertebra → Less than breadth of one ala

- Corporobasal index:
  - Male → Breadth of body of 1st sacral vertebra >1/3rd of breadth of base of sacrum.
  - Female → Breadth of body of 1st sacral vertebra is <1/3rd of breath of base of sacrum.

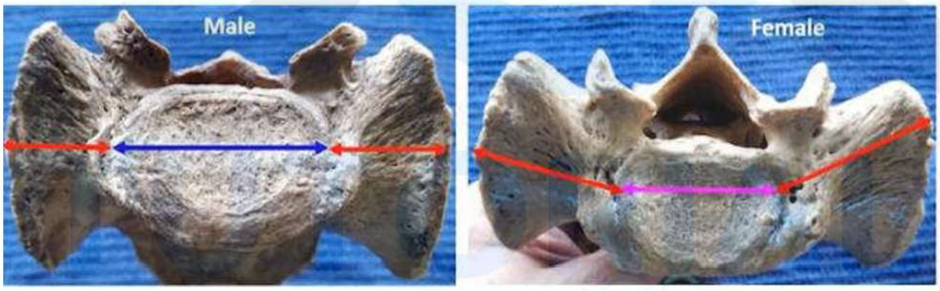
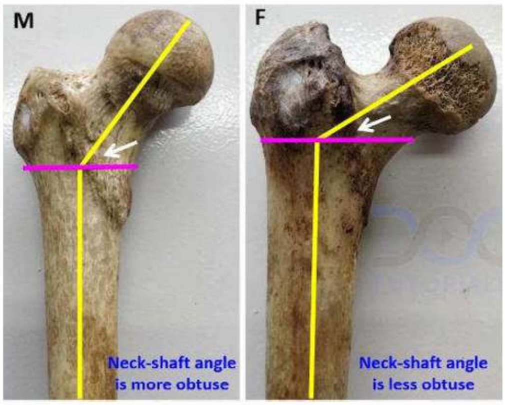


Fig: 26

$$\text{Corpobasal index} = \frac{\text{breadth of } 1^{st} \text{ sacral vertebrae}}{\text{Breadth of base of sacrum}} \times 100$$

DIFFERENCE BETWEEN MALE AND FEMALE FEMUR	
Male	Female
Neck-shaft angle → More obtuse	Neck-shaft angle → Less obtuse
Auricular surface of the head → Forms more than 2/3 of the sphere	Auricular surface of the head → Forms less than 2/3 of the sphere
Outer angle of the femur → around 80°	Outer angle of the femur → Around 76°
Bicondylar width → More (74-89mm)	Bicondylar width → Less (67-76mm)

- Neck shaft angle
  - Males → Neck shaft angle is more obtuse
  - Females → Neck shaft angle is less obtuse



Neck-shaft angle is more obtuse

Neck-shaft angle is less obtuse

Fig: 27

Sex differences in sternum 00:38:14

1.Ashely's rule of 149

- It is used to determine the sex of a person.
- According to Ashley, the length of manubrium + body in
  - Males → >149mm
  - Females → <149 mm

2.Hyrtl's law

- To determine sex of a person
  - Males → body is longer and more than twice the length of the manubrium
  - Females → body is shorter and less than twice the length of the manubrium.

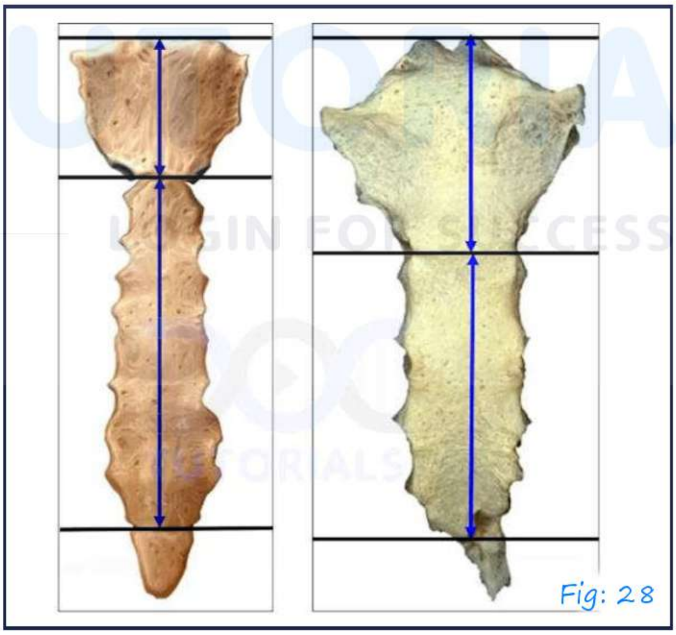


Fig: 28

Age from bones 00:40:23

Mandible:

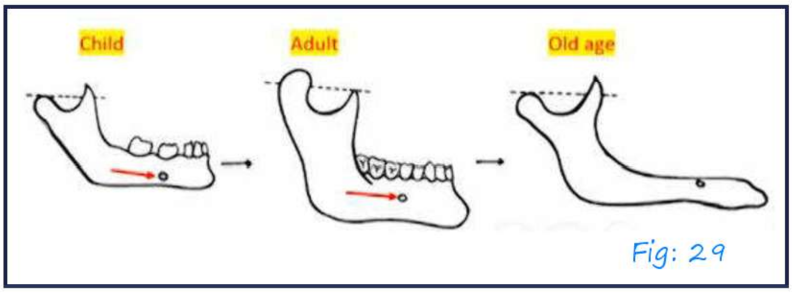

Child
Adult
Old age

Fig: 29

Trait	Child	Adult
Angle	About 1400	About 1100
Mental foramen	Near lower border	Middle
Level of condyle	Below coronoid	Above coronoid

- Best bone to assess age between 20-50yrs is pubic symphyses

Appearance & fusion of ossification centres (OC) 00:43:33

1.Sterum

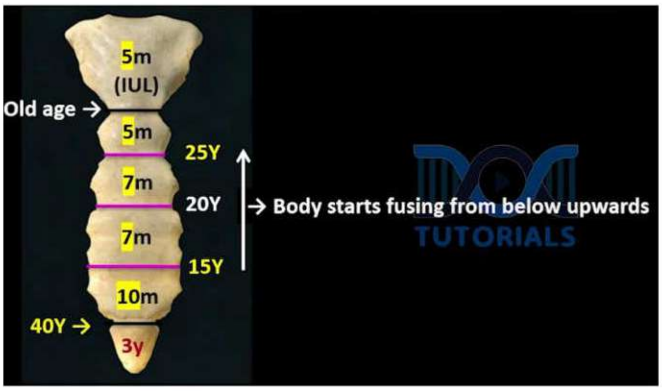

5m
(IUL)
Old age →
5m
25Y
7m
20Y
7m
15Y
10m
40Y →
3y
→ Body starts fusing from below upwards

Fig: 30

- Ossification centre for the manubrium and 1st piece of the body of the sternum appears at 5th month of IUL, 2nd & 3rd piece of the body of the sternum appears at 7th of month of IUL and 4th piece of the body appears at 10th month of IUL.
- Ossification centre for Xiphisternum appears at the age of 3 years.
- Body starts fusing from below upwards
- 4th piece with 3rd piece → 15yrs
- 3rd piece with 2nd piece → 20yrs
- 2nd piece with 1st piece → 25yrs
- Xiphisternum fuses with the body at 40 years.
- Body fuses with the manubrium at old age.

2.Foot

i. Calcaneum appears at 5th m of IUL

ii. Talus appears at the 7th month of IUL

iii. Cuboid appears at 10th month of IUL

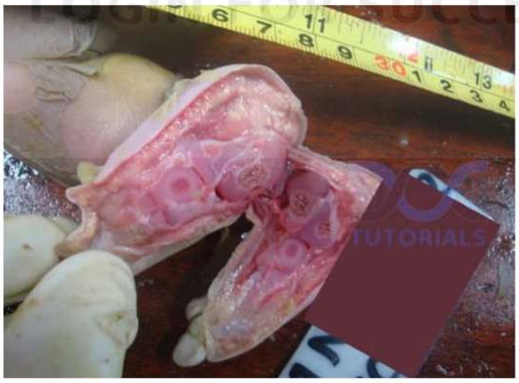


Fig: 31

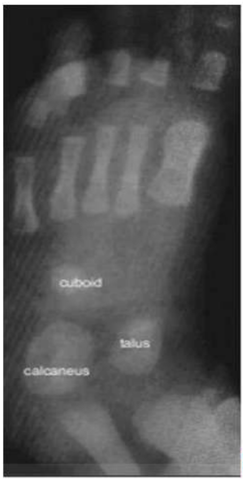


Fig: 32

3.Knee

- Lower end of femur appears at 9th month of IUL
- Upper end of tibia appears at 10th month of IUL

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LOGIN FOR SUCCESS

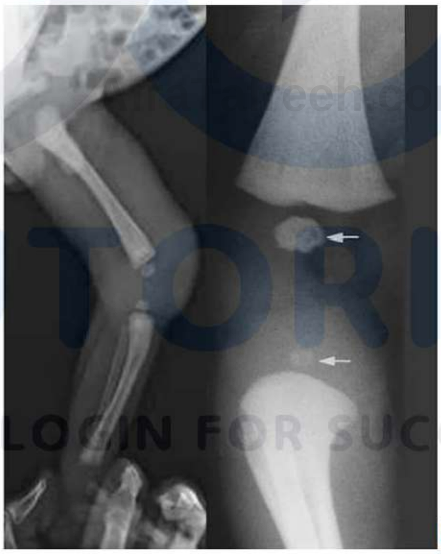

Fig: 33

4.Carpal bones

Carpal bones	Age of appearance
Capitate (C)	2m
Hamate (H)	3m
Triquetrum (T)	3y

Lunate (L)	4y
Scaphoid	4-5y
Trapezium	4-5y
Trapezoid	4-5y
Pisiform	9-12y

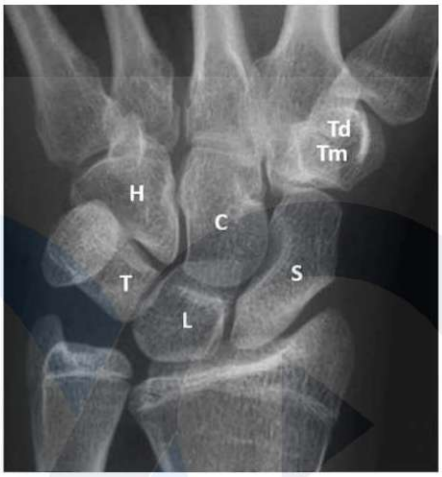

Fig: 34

Age in years	No. of carpal bones
1	2
2	2
3	3
4	4
5	7
12	8

5.Clavicle

- Shaft of the clavicle is the first OC to appear in the body at 5-6 weeks of IUL.
- Inner end of clavicle is the last OC to appear at 15-20y and last OC to fuse at 25Yrs.

6.Pelvis

- Iliac crest → Appears at the age of 14yrs & fuses at the age of 20yrs.
- Ischial tuberosity → Appears at the age of 16yrs & Fuses at the age of 20yrs.
- Sacral bones start fusing from below upwards at 20yrs and becomes a single bone at 25 years.

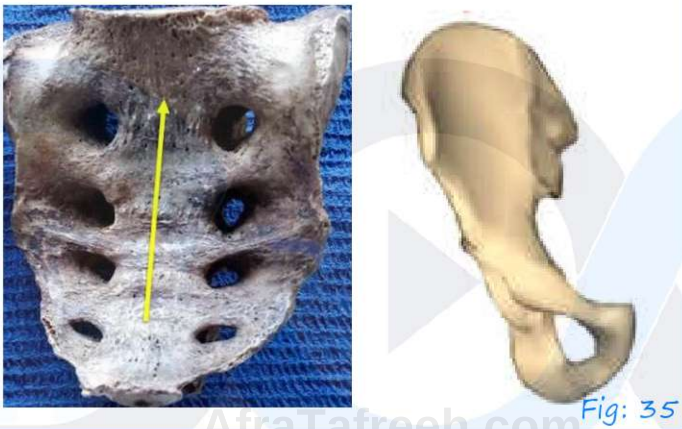
Fig: 35

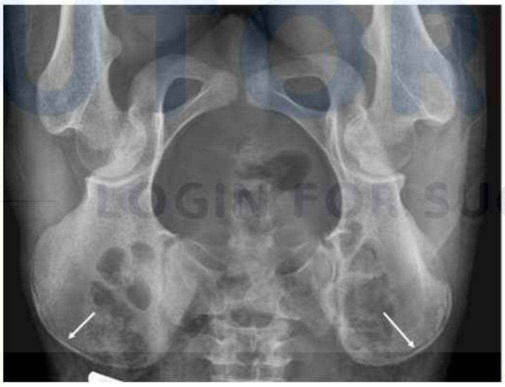
Fig: 36

7.Shoulder joint

Ossification centre	Appearance	Fusion
Head	1yr	–
Greater tubercle	3yr	–

Lesser tubercle	5yr	–
Conjoint epiphysis	6yrs	18yrs
Acromion process	16yrs	20yrs

8.Elbow joint

Ossification center	Appearance	Fusion
Capitulum	1yr	
Medial epicondyle	5-7yrs	15yrys (F)
Trochlea	10yrs	
Lateral epicondyle	11yrs	
Conjoint epiphysis (By fusion of lateral epicondyle, Trochlea and capitulum)	Formed at 12yrs (F) 13yrs (M)	14yrs (F) 15yrs (M)
Upper end of radius	5yrs	16yrs
Upper end of ulna	9yrs	16yrs

Conclusion

- Elbow joint helps in age estimation of a female of 14yrs, 15yrs & 16yrs and a male of 15yrs & 16yrs.

9. Wrist joint

Ossification center	Appearance	Fusion
Lower end of ulna	6yrs	19yrs
Lower end of radius	2yrs	19yrs
Base of 1st metacarpal	2-3yrs	15-17yrs

10. HIP joint

Ossification center	Appearance	Fusion
Head of femur	1yrs	17yrs
Greater trochanter	4yrs	17yrs
Lesser trochanter	14yrs	17yrs
Tri radiate cartilage	13yrs	15yrs
Iliac crest	14yrs	20yrs
Ischial tuberosity	16yrs	20yrs

11. Knee joint

Ossification center	Appearance	Fusion
Lower end of femur	9th month of IUL	18yrs
Upper end of tibia	10th month (at birth)	18yrs
Upper end of fibula	4yrs	18yrs

12. Ankle joint

Ossification center	Appearance	Fusion
Lower end of tibia	1yr	17yrs
Lower end of fibula	1yr	17yrs

Fusion at various joints 01:03:42

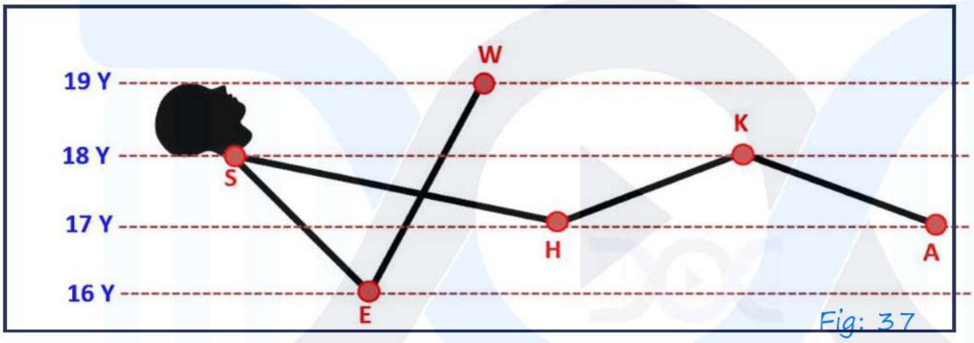

Fig: 37

X-ray

i. Shoulder joint

- If the upper end of humerus is not fused, you can see a gap i.e. trace the lateral line between the epiphysis & diaphysis
- If no gap & the lateral line is continuous, that means it's fused.

ii. Elbow joint

- 1st Picture → Not fused i.e.
    - Medial epicondyle not fused
    - Conjoint epiphysis not fused
    - Upper end of the radius not fused

- 2nd picture → fused

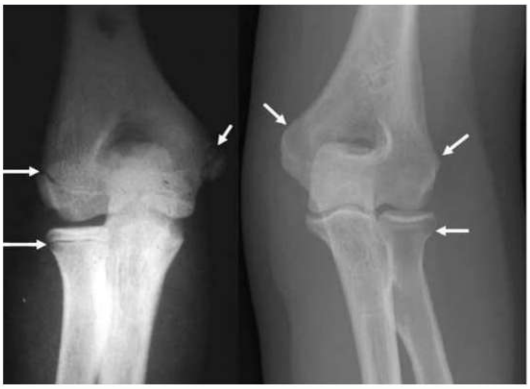

Fig: 38

iii. Wrist joint

1st picture → Lower end of radius & ulna not fused.

2nd picture → Fused

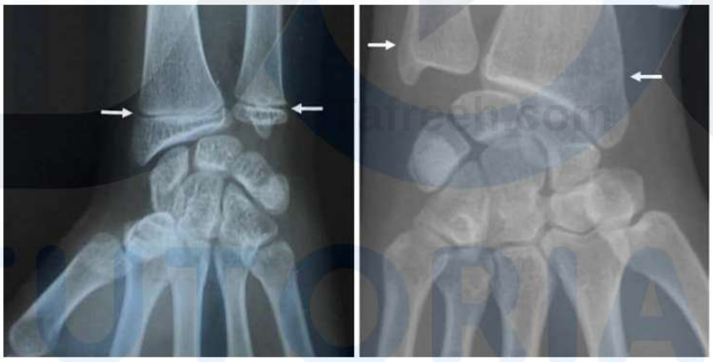

Fig: 39

iv. Hip joint

1st picture → - Head not fused
- Greater trochanter not fused
- Lesser trochanter not fused

2nd picture → Fused

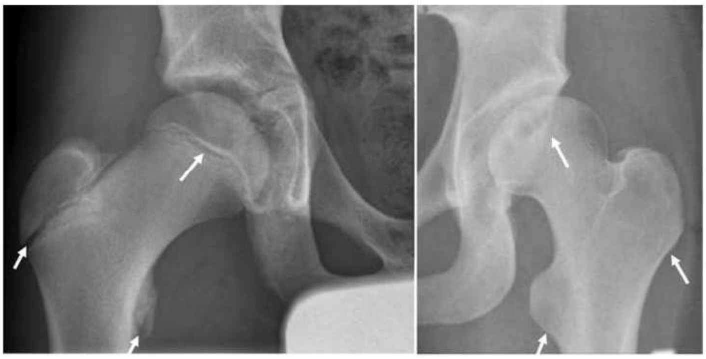

Fig: 40

v. Knee joint

1st picture → Lower end of femur not fused

Upper end of tibia & upper end of fibula

Not fused

2nd picture → Fused

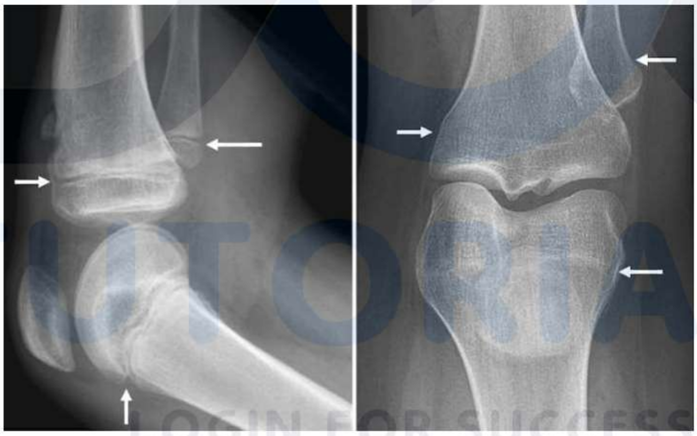

Fig: 41

vi. Ankle joint

1st picture → Lower end of tibia & fibula fused

2nd picture → fused

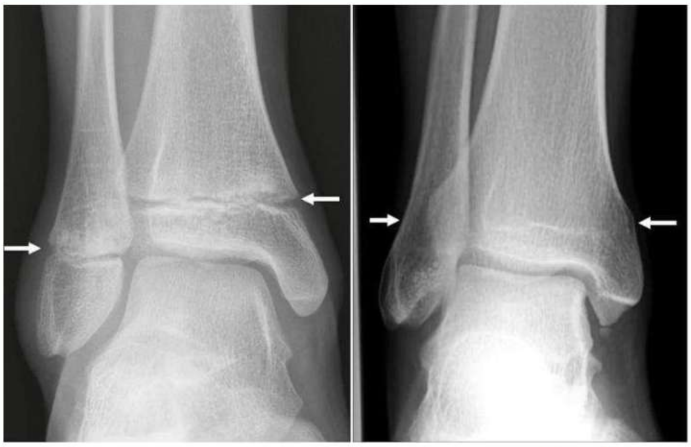

Fig: 42

Cranial sutural fusion 01:12:00

- Anterior fontanelle fuses at 18-24months
- Posterior fontanelle fuses at 6-8months
- Posterolateral & anterolateral → <2m
- Cranial suture to fuse
  - First → Metopic → 2-6yrs
  - Last → 1. Masto occipital & 2. Parieto temporal → 80 yrs (1 > 2)
- Basi-occiput fuses with basi-sphenoid at 18-21years

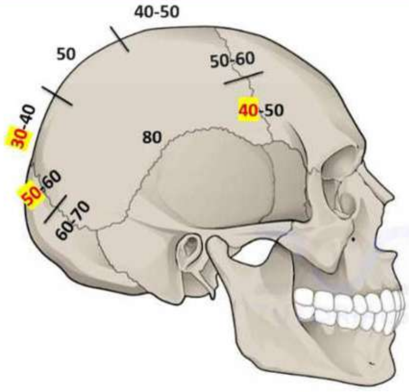

Fig: 43

- Endocranial sutures fuses 5-10yrs earlier than ectocranial sutures
- Start of sutural closure
  - Sagittal → 30 - (5-10) = 20-25yrs
  - Coronal → 40 – (5-10) = 30-35yrs
  - Lambdoid → 50 – (5-10) = 40-45yrs
- Lapsed union occurs most often in sagittal suture

Stature from bones 01:18:57

- Device used to estimate the length of long bone is Hepburn osteometric board, modified by Trevor
- Various regression formulae are used to estimate the stature, such as:
  - Jit and sing formula
  - Trotter & Glesser's formula
  - Karl–Pearson's formula
  - Dupertuis & Hadden's formula
- The stature from fragmentary remains of bones can be estimated by McKern & Steele formula.
- The stature form foetal bones can be estimated by Smith and Fidde's formula.

Estimation of stature from long bones by multiplication factor 01:21:38

Bone		Multiplication factor
Femur		3.7
Tibia/Fibula	+0.8	4.5
Humerus	+0.8+	5.3
Ulna	+0.8	6.1
Radius	+0.8/2	6.5

- The humerus is 20%, Tibia is 22%, Fibula is 22%, Femur is 27% and Spine is 35% of stature of a person.

Extra Edge topics 01:25:46

Indices To Differentiate Race

1. **Cephalic index** = $\frac{\text{Max. breadth of skull}}{\text{Max. length of skull}} \times 100$

2. **Brachial index** (Radio-humeral index) = $\frac{\text{Length of Humerus}}{\text{Length of Radius}} \times 100$

3. **Crural index** (Tibio-femoral index) = $\frac{\text{length of tibia}}{\text{Length of femur}} \times 100$

3. **Intra-membral index** (Humero-femoral index) =

$\frac{\text{length if Humerus}}{\text{Length of femur}} \times 100$

4. **Inter-membral index** =

$$\frac{\text{length if Humerus + length of radius}}{\text{Length of femur + length of tibia}} \times 100$$

Indices to differentiate sex from bones

1. Sternal index:

$$\frac{\text{Length of Manubrium}}{\text{Length of body}} \times 100 \text{ (males:46.2; females 54.3)}$$

2. Ischio-pubic index :

$$\frac{\text{Length of Pubis}}{\text{Length of Ischium}} \times 100$$

3. Sciatic notch index :

$$\frac{\text{Width of Sciatic notch}}{\text{Depth of sciatic notch}} \times 100$$

4. Sacral Index :

$$\frac{\text{Width of Sacrum}}{\text{Length of sacrum}} \times 100$$

5. Corporo-basal index :

$$\frac{\text{Length of body of S1}}{\text{Length of base of sacrum}} \times 100$$

6. Medullary Index:

$$\frac{\text{Diameter of whole bone}}{\text{Diameter of Medulla}} \times 100$$

(Also used to differentiate human hair from animal hair)

- Patella ossifies from multiple centers at 3 to 6 years and
- becomes a single bone at puberty
- Calcification of hyoid bone and thyroid cartilage occur after the age of 40 years

- The greater cornu of hyoid bone unites with the body between 40 and 60 years
- The two halves of the mandible unite at the 2nd year
- The best minor bone for determination of sex is 2nd metacarpal bone
- Perforated olecranon fossa is more common in females on left side
- Cranial sutures close later in females than males
- The lapsed union occurs most often in sagittal suture
- Out of all cranial sutural closures,
- Sagittal suture is more reliable than lambdoid, and
- Lambdoid is more reliable than coronal
- Lateral view of x-ray is used to observe the skull sutures

"Greulich and Pyle" Method:

- It is a technique for evaluating the bone age of children
- by using a single x-ray of the left hand, fingers, and wrist
- The bones in the x-ray are compared to the bones of a standard atlas.

MEDICO LEGAL AUTOPSY PART – I

Autopsy 00:00:25

- Autopsy is also known as
  - Postmortem examination
  - Necropsy
  - Thanatopsy
  - Sectio cadaveris

Types of Autopsy 00:01:14

i. Medicolegal autopsy

- Consent of the party is not required.
- Authorization is given by I.O. (Investigating officer)
- Identification of the dead body at the autopsy table is done by police.
- After postmortem, the body is handed over to I.O.
- Minimum qualification required to perform autopsy is MBBS.
- All 3 major body cavities must be opened.
- When a dead body of a murdered person is brought for preserving in the mortuary the following is done:
- The body should be stored averagely at 4°C.
- The body can be stored at -20°C to preserve if for long duration.
- The body should never be undressed before the forensic doctor has seen it.

ii. Clinical/Academic/Pathological Autopsy

- Consent of the party is required.
- Done in natural deaths by a pathologist for academic interest.

iii. Negative Autopsy (2-5%)

- Absolutely no findings after external and internal examination, HPE and chemical analysis.
- Opinion as to the cause of death cannot be given.
- Due to functional failure of a vital tissue/organ. e.g., Death due to vagal inhibition, laryngeal spasm etc.

iv. Obscure Autopsy

- There are minimum findings (not clear cut), but cannot correlate with the cause of death after external & internal examination, HPE & chemical analysis.
- Opinion as to the cause of death cannot be given.

v. **Virtual Autopsy** (Radiological autopsy/Virtopsy)

- It is a non-invasive procedure.
- Done by using CT scan, MRI, USG & X-ray.

vi. Psychological Autopsy

- When it is difficult to decide the manner of death by conventional autopsy.
  e.g., – Suicide
- Assessment of the mental state of deceased person before death.

vii. Minimally invasive autopsy

a. Needle autopsy
   - Only sample of tissue are taken by biopsy needle.

b. Echopsy (ultrasonographic autopsy)
   - Needle autopsy, where samples are obtained under USG control.

c. Endoscopic or laparoscopic autopsy

d. Toxopsy
   - Toxicological examination of body fluids.

Skin incisions at autopsy 00:16:39

i. 'I' shaped incision

From symphysis menti to Symphysis pubis avoiding the umbilicus.

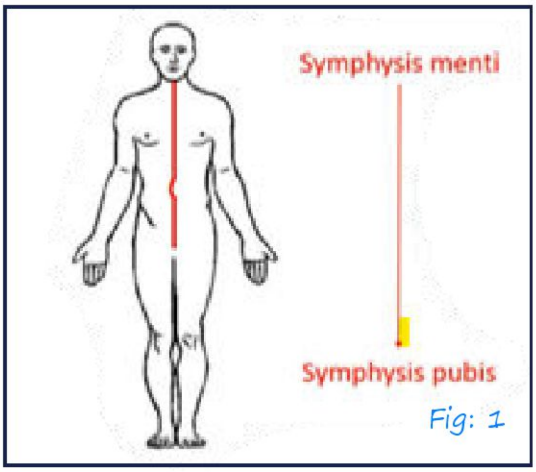

Fig: 1

- It is the most common and routine incision.

  It is done also because:

  - Sometimes because of the presence of concealed puncture wounds.
  - Cosmetic purposes
  - It is a cicatricial tissue, hence avoided.

ii. "Y" shaped incision

- Starts from both the mastoid to reach the sternal notch & further extending to reach the symphysis pubis, avoiding the umbilicus.

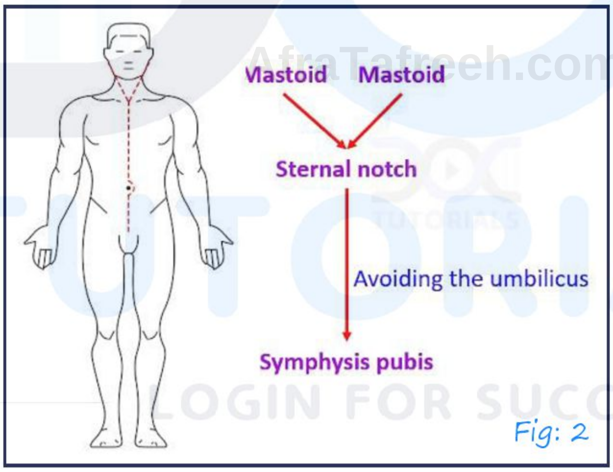
Mastoid
Mastoid
Sternal notch
Avoiding the umbilicus
Symphysis pubis

Fig: 2

- Done in neck injuries and asphyxial deaths by compression over the neck.

iii. Modified 'Y' shaped incision

- Incision extends from both the acromion, running away & below the breast to reach xiphisternum and

DOC TUTORIALS
LOGIN FOR SUCCESS

then extending to symphysis pubis, avoiding the umbilicus.

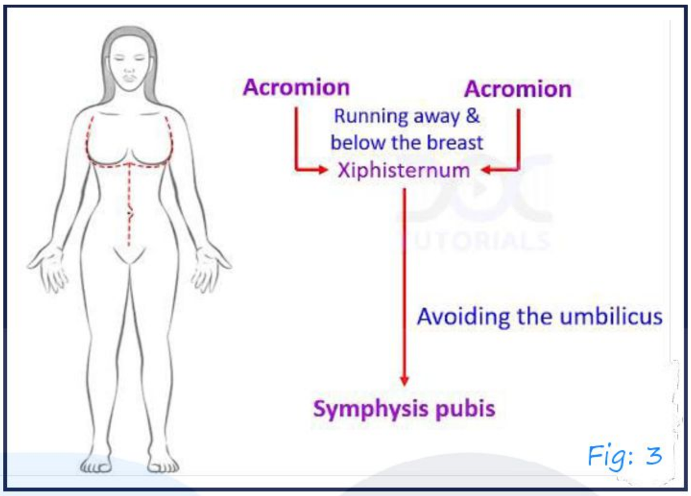
Acromion
Acromion
Running away & below the breast
Xiphisternum
Avoiding the umbilicus
Symphysis pubis

Fig: 3

- Done in females for cosmetic purpose.

iv. 't' shaped incision

- A vertical incision extending from the symphysis menti to the pubic symphysis avoiding the umbilicus and a horizontal incision from one acromion to another acromion passing through sternal notch.

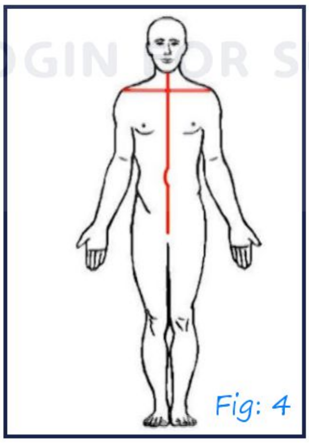

Fig: 4

- This is done to explore the base of the neck to study the vertebral arteries.

v. Inverted 'Y' shaped incision

- It is used in foetus & new born to study umbilical arteries.
- Extending from symphysis menti to umbilicus to bilateral mid inguinal point.

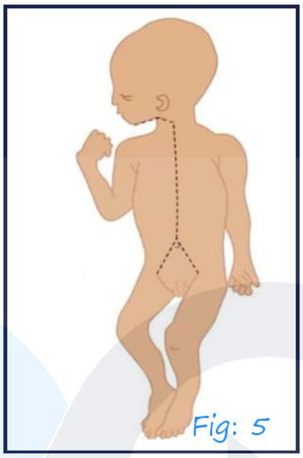

Fig: 5

vi. 'X' shaped incision

- Routine 'I' shaped incision + from front of both wrists to reach the sternal notch and from pubic symphysis to both ankles passing over the front of lower limbs. Backside as shown in the picture.
- It is done in suspected torture.

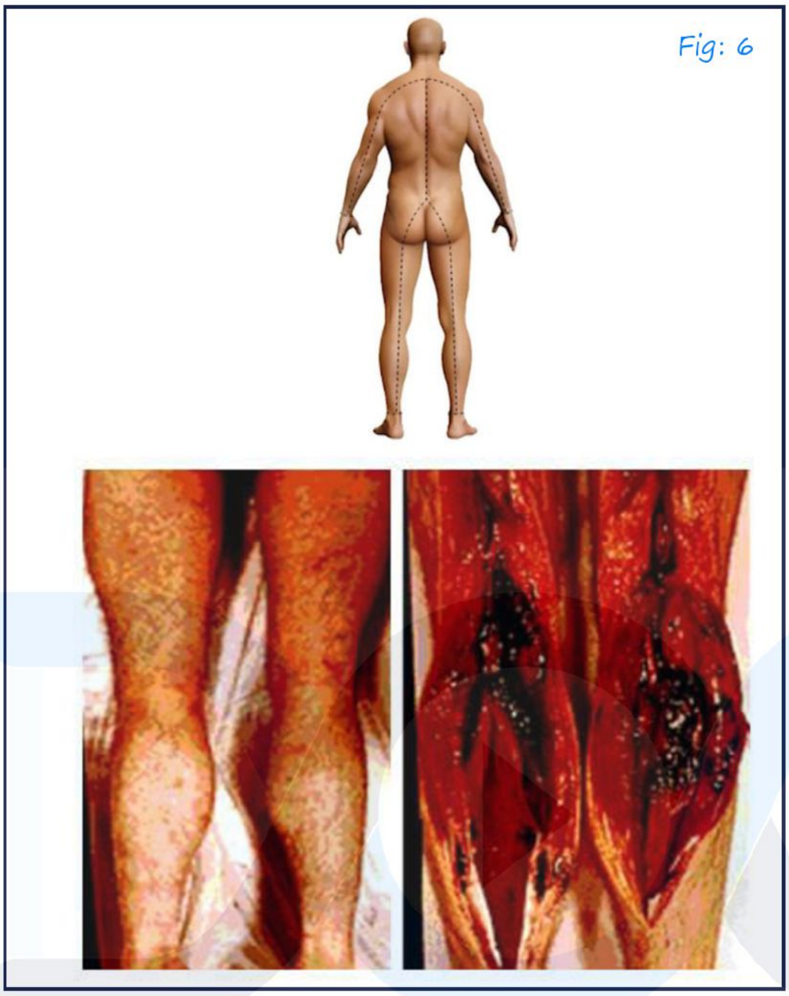

Fig: 6

Scalp Incision

- Mastoid to vertex to mastoid.

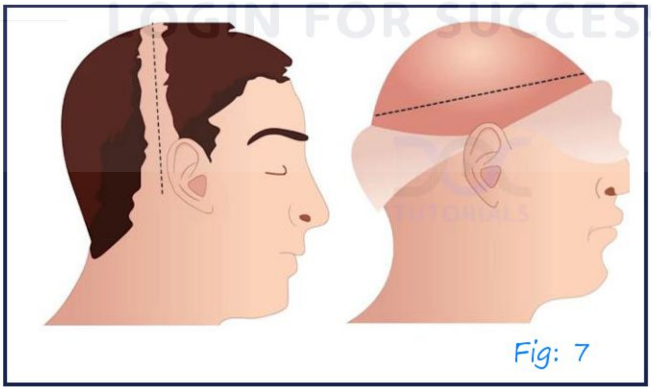

Fig: 7

To open the skull 00:27:45

- Skull is sawn from superciliary ridges in front to occiput behind in a circular fashion.
- Three methods can be used

  i. Straight cut

  ii. 'V' cut

  iii. Zig zag

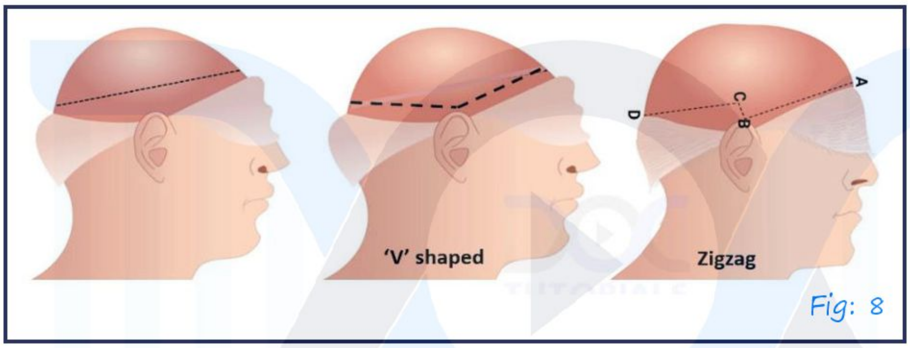

Fig: 8

- All the medical colleges should have Styker autopsy sew.

Fig: 9

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To open the foetal skull 00:29:41

- There are 2 techniques

  i. Beneke's technique

  - The skull is opened in 2 flaps: Right & left fronto-temporo-parietal flaps

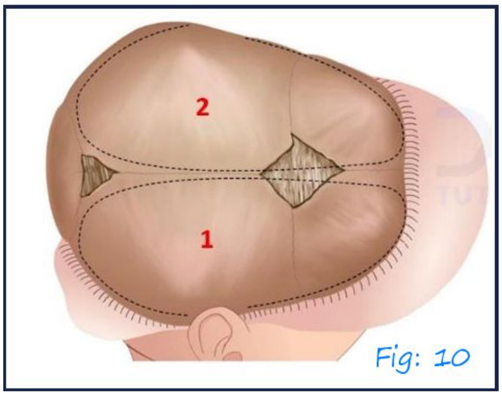

Fig: 10

ii. Barr's technique

- Skull is opened in 4 flaps: 2 frontal & 2 parietotemporal

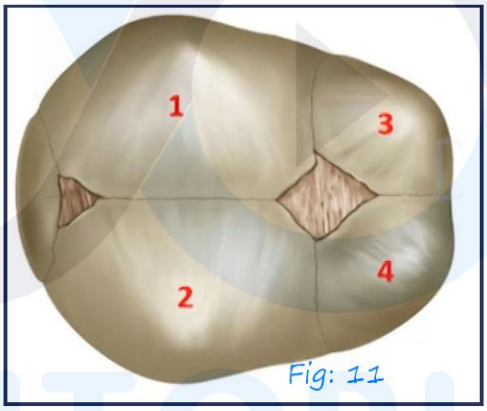

Fig: 11

- Barr's is more commonly used than Beneke's technique.

Autopsy Incision 00:31:03

i. Primary autopsy incision → skin & scalp

ii. Secondary autopsy incision → skull & rib cage

iii. Tertiary autopsy incision → serous membrane

iv. Quaternary autopsy incision → Viscera.

Techniques of Autopsy 00:32:39

I. Letulle's technique

- Also known as 'En masse' or 'En bloc' dissection.
  - En masse = In a group; all together.
  - En bloc = All together or all at the same time
- Oral, cervical, thoracic, abdominal and pelvic organs are removed as one large organ block.
- Commonly done in medical colleges to teach students.

II. Gohn's Technique

- It is also known as 'block by block' dissection
- Cervical & thoracic organs, abdominal organs and the urogenital system are removed as separate organ blocks.

III. Virchow's technique

- Organ by organ removal.
- Most common method used in India.

IV. Rokitansky's technique

- In-situ dissection.
- Done in infected & suspected infection cases.

Body cavity to be opened first 00:40:55

i. Routine cases → Choice of the dissector.

- As a general rule head is opened first

ii. Head injury

- Head

iii. Pulmonary air embolism

- Chest

iv. Cerebral air embolism

- Head

v. Fetal autopsy

- After skull, abdomen to be opened before thorax → To see the level of the dome of the diaphragm.
  - Before respiration: At the level of 4th/5th rib.
  - After respiration: At the level of 6th/7th rib

vi. Cyanide poisoning

- Head → To perceive the bitter almond smell (before contamination)

vii. Asphyxial deaths with neck compression & neck injury cases

↓

Bloodless dissection of the neck is preferred

↓

Open the head, thorax & abdomen

↓

Remove all organs

↓

Neck to be opened last.

Spinal Cord 00:46:51

- In routine autopsy → Not removed.
- If to be removed, best approach is "anterior"
- Most commonly used is "posterior approach"
- Rachiotomy saw is used to remove spinal cord.

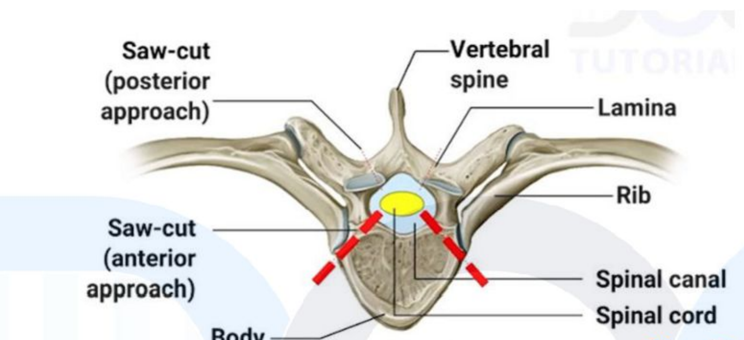
Saw-cut (posterior approach)
Vertebral spine
Lamina
Rib
Saw-cut (anterior approach)
Spinal canal
Spinal cord
Body

Fig: 12

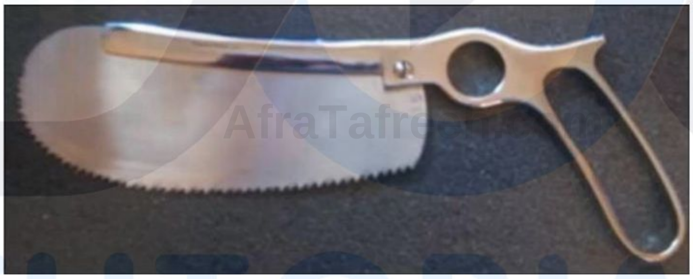

Fig: 13

Dissection of Heart 00:49:03

- Heart is dissected as per the direction of the flow of the blood (Inflow-outflow technique)
- Rt. Atrium → Rt. Ventricle → Pul. Artery → Pul. Vein → Lt. Atrium → Lt. ventricle → Aorta
- The chamber to be opened in heart dissection is in an order of

  RA → RV → LA → LV

Dissection of Stomach 00:51:01

- Stomach is dissected along the greater curvature from cardiac to pyloric end.

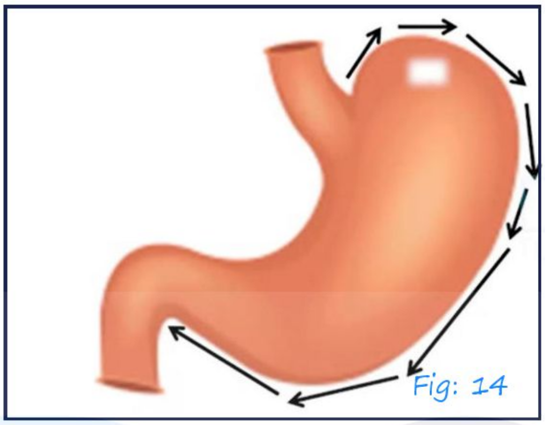

Fig: 14

MEDICOLEGAL – AUTOPSY PART II

Preservation of viscera in poisoning 00:00:17

1.In Routine cases

- Bottle no. 1
  - Stomach with its contents
  - Upper intestine (About 30cm) with contents
- Bottle no. 2
  - Liver (About – 300gm)
  - Kidney (Half each)
- Bottle no. 3
  - Blood (30ml, min. 10ml)
- Bottle no. 4
  - Urine (30ml)

2.In known cases

- Preserve the organ on which the poison acts.
- In neurotoxics, strychnine and volatile poisons about 100gm of brain is preserved.
- In strychnine poisoning the brain and spinal cord is preserved along with CSF.
- In cardiac poisons and strychnine, you have to also preserve the heart. Eg: digitalis, pink oleander, yellow oleander, nicotine etc.
- In case of inhalational poisons, alcohol and HCN, Lung is to be preserved → No preservatives → Keep in a metal container or nylon bag and seal it.

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- Uterus should be preserved for analysis in case of death due to criminal abortion.
- Fat from mesentery is to be collected for chemical analysis in deaths due to inhalational anesthesia.
- Abdominal fat or perinephric fat has to be preserved in poisoning by pesticides.

Chronic poisoning by heavy metals 00:07:41

- Arsenic, antimony, radium, thallium (AART): These get deposited in the keratin as well as bone & muscle.
- Therefore preserve
- 1 square inch of skin
- All 20 nails
- 20-30 pulled scalp hair
- 10cm of length of shaft of femur
- About 1 cubic inch of muscle (Quadriceps)
- In case of putrefied body, Skeletal muscle of about 3 X 3 cm from the thigh is preserved
- If the body is already embalmed, skeletal muscle of about 3 X 3cm from the buttock is preserved.
- Spleen is the most ideal organ for preservation for cyanide & CO poisoning & is also best organ for culture in septicemia.
- Additional viscera to be selected at autopsy

Preservatives used

Heart	Cardiac poisons, strychnine
Brain (100g)	Neurotoxic poisons, CO, Cyanide, Strychnine, Anesthetics and Volatile poisons
Muscle (3cm X 3cm)	If the internal organs are badly putrefied → From thigh in an embalmed body → From buttock
Fat	Pesticides → Abdominal or Perinephric fat Anesthetics → Mesenteric fat
Skin	Injected poisons and corrosives on the skin
V. Humor	Alcohol, Chloroform, Cocaine, Morphine, Tricyclic antidepressants
Bile	Narcotic drugs, Cocaine, Barbiturates, Methadone, Glutathione, Some tranquilizers

Preservatives used

- For chemical analysis
- Rectified spirt (Best)
- Supersaturate NaCl (Commonly used)
- For histopathology
- 95% alcohol (Best)
- 10% formalin (Commonly used)

Contraindications for preservatives 00:14:55

NaCl (Common salt)	**Rectified spirit**
- Alkalis - Aconite - Corrosive acids except phenol - Corrosive sublimate	- Alcohol - Phenol - Phosphorous (Phosphorescence is diminished) - Acetic acid - Chloroform, chloral hydrate - Ether - Formic acid, Formaldehyde - Kerosene - Paraldehyde

Blood 00:17:48

- For toxicological study → Drawn from femoral vein
- Alternatively → Jugular/Subclavian vein
- Minimum quantity → 10ml
- Preservative used → NaF (Enzyme inhibitor), 100mg/10ml + K oxalate (30mg/100ml)
- NaF or KF prevents glycolysis, inhibits enzymatic activity and bacterial growth.
- For bacteriological study (Culture) → From right ventricle
- Anticoagulant used → SPS (Sodium polyanethole sulfonate)

Most ideal specimen for alcohol 00:20:29

- Most ideal specimen → Vitreous humor
- Preservative used → NaF (10mg/10ml)
- CSF also to be preserved
- Preservative used for urine are
- NaF
- Na benzoate
- Thymol
- Toluene (better)
- In alcohol poisoning → NaF/Phenyl mercuric nitrate (PMN) should be used.
- In Gouty tophus (uric crystals) → Alcohol is used as preservative.

Preservatives USED at autopsy

Enzyme	Liquid nitrogen in thermos flask
Virological studies	Liquid nitrogen in thermos flask or 50% glycerol in buffered saline
Blood in volatile/Gas poisoning	Add a layer of 1-2cm liquid paraffin to avoid evaporation
Blood for DNA	EDTA/Heparin
Muscle for DNA	Dimethyl sulphoxide (DMSO)
Maggots	Acetic alcohol

- Bitten fruit is preserved in
  1. Na metabisulfite (Campden's solution). Alternative preservatives are
  2. formol-aceto-alcohol (FAA) and
  3. Formalin (1>2>3)

Ideal source for DNA extraction 00:26:04

- If the dead body is fresh → Blood
- In early decomposition → Muscle > Skin > Spleen

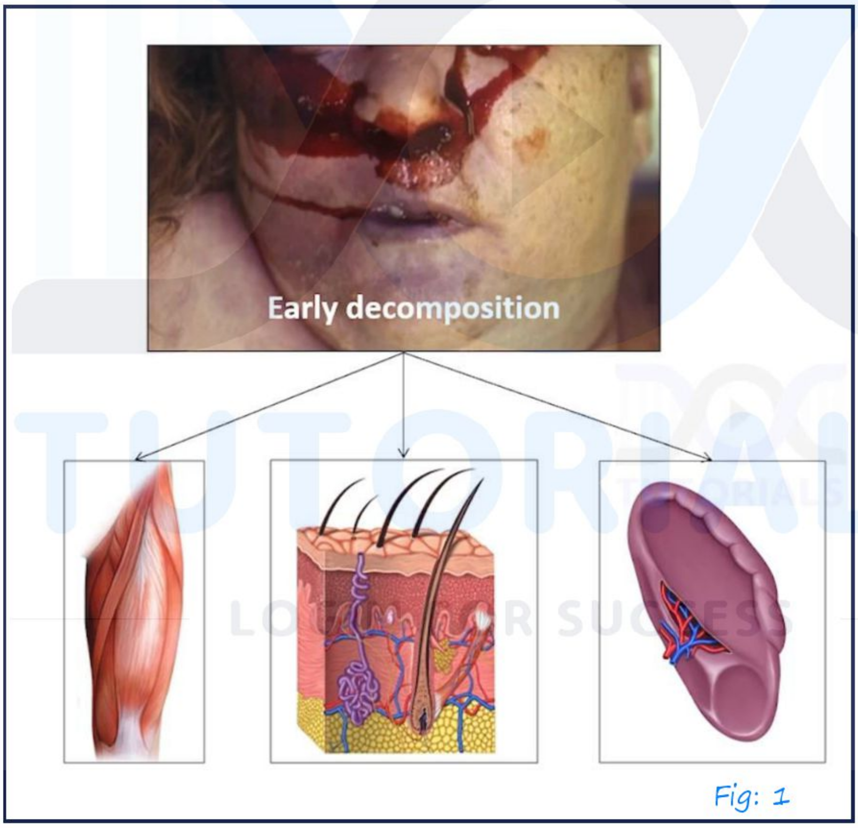

Fig: 1

- In late decomposition → Bone > Molar teeth > Hair root sheath

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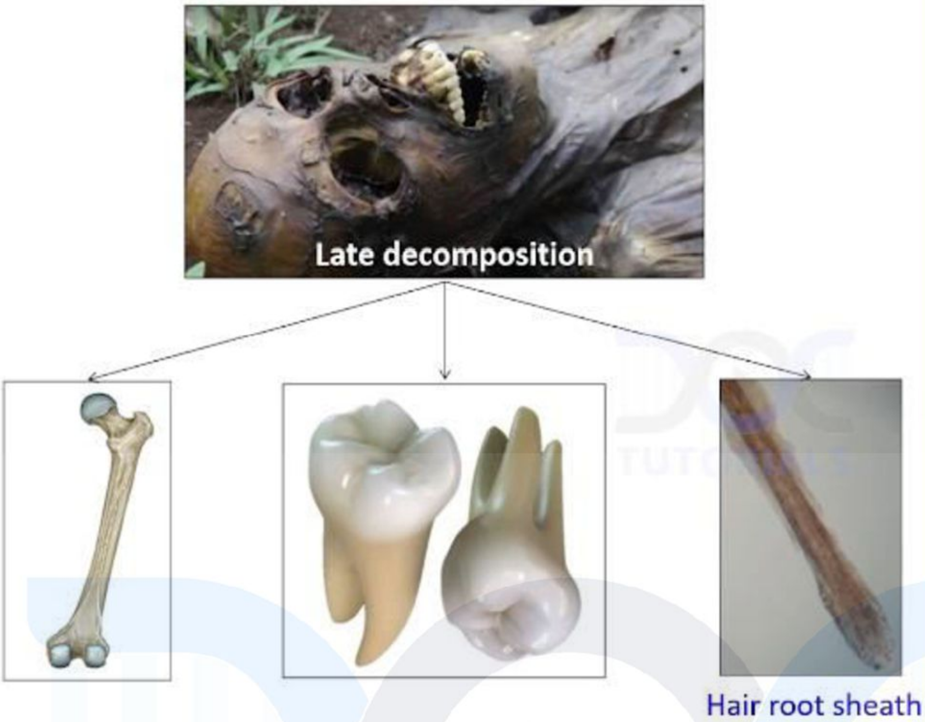

Fig: 2

- RBCs are not a potential source of DNA (No nucleus)
- At autopsy oedematose brain has obliterated sulci
- Weight of the brain is increased by about 10% in adults & about 15% in children due to fixation in formalin

Difference between antemortem & postmortem clots 00:29:35

- Antemortem clots → Firm, rubbery and attached to the vessel by lines by Zahn
- Postmortem clots → Soft, friable, having appearance of red currant jelly (Red cells) & Yellow chicken fat (Serum) and not attached to the vessel wall

- Alkaline pyragolol test is used to differentiate air embolism from putrefactive gases (4 mL of alkaline pyrogallol is taken in a 10ml syringe and air is aspirated from right side of the heart.
- The needle is removed and replaced by a stopper.
- If air (Oxygen) is present, the mixture turns brown on shaking.
- In case of putrefactive gases, the color doesn't change)

Embalming 00:32:26

- It is a method of preserving dead body by using embalming fluid
- The chemicals are usually injected into carotid artery

Typical embalming fluid

Ingredient	Use	Proportion
Formalin*	Preservative	1.5L
Methanol	Preservative	500ml
Phenol	Germicide	50ml
Glycerine	Wetting agent	600ml
Thymol	Fungicide	5g
Sodium borate	Buffer	600g
Sodium citrate	Anticoagulant	900g
Sodium chloride	Controls pH	800g

Eosin (1%)	Cosmetic	30ml
Soluble wintergreen	Perfume	90ml
Water	Vehicle	Up to 10L

- Ethanol is not an ingredient of typical embalming fluid.
- Formaldehyde injected for embalming is 40%. Formalin is 37% by wt. or 40% by volume, aqueous solution of formaldehyde

Methods for injecting embalming fluid 00:35:14

1. Continuous injection & drainage
2. Continuous injection & disrupted drainage
3. Alternate injection & drainage
4. Discontinuous injection & drainage (Best)
    - High pressure low flow rate is preferred while injecting embalming solution to avoid problem in arterial embalming.
    - Gamora green discoloration is seen in arterial embalming of jaundice case.

Embalming 00:36:54

- Without death certificate → punishable under 201 IPC (Disappearance of evidence)

- Without consent → 297 IPC (Indignity to human corpse)
  (Even necrophilia/necrophagia are punishable under this section)

Unclaimed body 00:38:55

- A dead body is declared unclaimed body as per
- Delhi anatomy act 1953 → After 48hrs
- Police manual → After 72hrs

Exhumation (Disinterment) 00:39:48

- Done on written order from executive magistrate.
- No time limit in India. (in France and Germany the time limit is 10yrs and 30yrs respectively)
- Body is exhumated under the supervision of a Magistrate in the presence of doctor & police.
- Usually done in the early morning.
- In case of suspected poisoning
- 6 soil sample of about 500g each should be taken from each side of the body and 2 control sample from some distance.

Artefact 00:43:55

- It is a change in the natural state of the body that is likely to be misinterpreted at autopsy
- Artefact may be introduced

- Before death → known as therapeutic artifact
- At the time of death → known as agonal artifact
  Or Perimortem artefact
- After the death → known as postmortem artifact.

Prinsloo and Gordon artefact.

- Substantial hemorrhages may be seen over → Posterior surface of the oesophagus and anterior longitudinal ligament of cervical spine.
- This can be prevented by bloodless dissection of the neck

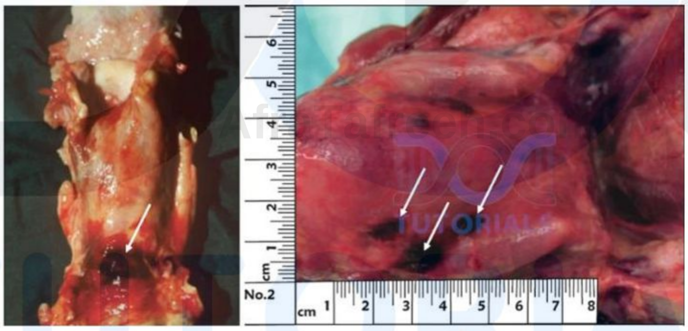

Fig: 3

Extra edge topics 00:48:36

- In case of death in a police custody and jail, remand home etc.,
  - post mortem should be video filmed and
  - the cassettes should be sent to human rights commission
  - along with PM report.
- Second autopsy

  - Is done usually by a board of 3 doctors
  - After an order from a magistrate
  - The presence of first autopsy surgeon is a must
- HIV remains viable in blood up to 2 months
- Post-mortem clotting
  - Initiates within 1 hour after death
  - Generally, in small capillaries blood is completely clotted by 8 hrs.
- Cardiac polyps
  - Post-mortem fibrinous clots in the heart
- In case of myocardial infarction
  - Histologically no changes in myocardial infarction (MI) for 4 hours.
  - Triphenyl Tetrazolium chloride and Nitro Blue Tetrazolium (Nitro-BT) are used in post mortem demonstration of MI
  - Tigroid (tiger like) appearance (alternate red and pale areas) is seen in 1-2 days in MI on gross examination.
- Sub Endocardial Haemorrhages (Sheehan's haemorrhages) are seen in:
  - Acute haemorrhage, abortion, asphyxia deaths
  - Brain tumors
  - Ectopic pregnancy
  - Head injury
  - Shock, stress

  - **Poisoning**: Arsenic, Antimony, P, Aluminium Phosphide abd Viper snake bite
- Adrenal haemorrhages seen in:
  - Burns, trauma, poisoning, head injury, fetal anoxia
  - Meningococcal septicewmia (Waterhouse Fredrickson syndrome)
  - Thrombosis of central vein, hypertension etc.

THANATOLOGY PART - I

Death & Early changes after death

- Thanatology means study of death and changes after death.
- A person 1 presumed to be dead if he has not been seen or heard for a minimum period of 7yrs under sec. 108 IEA.
- Commorientes – Literally means dying together.
  - Two or more people dying simultaneously or in circumstances rendering it uncertain which of them survived the other or others.
  - In such cases, the younger is deemed to have survived the older.

Tripod of life 00:03:45

- Tripod of life:
  - According to Bichat, it is the function of the → brain, heart and lungs
  - Bichats mode of death
  - Come
  - Syncope
  - Asphyxia

Death 00:04:55

1. Somatic/clinical/systemic death
   - Complete and irreversible cessation of the function of the brain, heart and lungs.
2. Molecular/cellular death
   - Individual cells die at varying period
   - **Supra-vital interval** (intermediary life) → period between somatic and cell death.
   - Immediate sign of death is cessation of circulation & respiration.
   - After stoppage of circulation muscles can live up to 1-2 hours.
   - 'Zasko' phenomenon → Quadriceps femoris contraction for Mechanical stimulation → up to 1-2 hours after death.
   - Anoxic anoxia is seen in cyanide poisoning.
   - Anemic anoxia is seen in CO poisoning

Suspended animation or Apparent death

00:09:11

- Vital functions are at such a low rate that, it's not possible to diagnose by routine clinical methods.
- Suspended animation can be
  - Voluntary e.g.: Yogis - Person can be revived
  - Involuntary
  - A: After Anaesthesia

  - B: in newborn Babies
  - C: Cholera/cerebral concussion
  - D: Drowning
  - E: Electrocution
  - Sunstroke, syncopal attack, insanity, hypothermial, shock, narcotic poisoning, vagal inhibition etc.
- After death, intraocular tension (IOT) becomes nil in 2 hours.
  - During life IOT is 10-21 mmHg.
  - Soon after death, it becomes half.
  - After 30 minutes, it becomes 1/8th
- Earliest sign of death is loss of skin elasticity (seen within few minutes after death)

Railroad phenomenon/Trucking/Kevorkian sign/Cattle trucking/Shunting 00:13:27

- After death blood breakup into segments & the blood cells get crumpled together & is alternated with serum which is well seen in retina on ophthalmoscopy

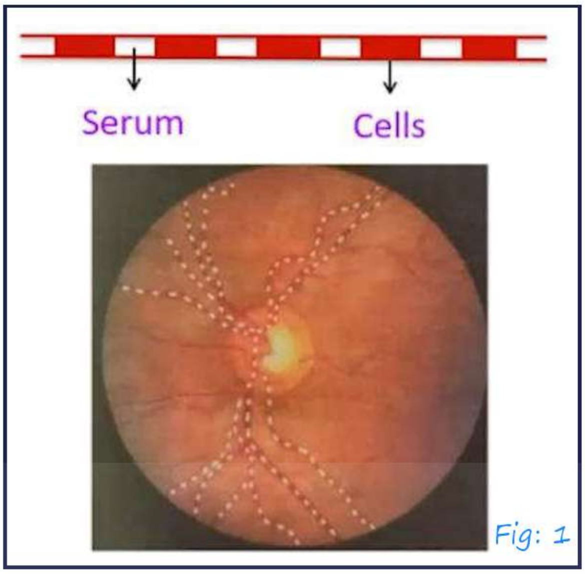

Fig: 1

- Apparent within 15 minutes.

Tache noir de la sclerotique 00:15:10

- Tache noir = Black spots

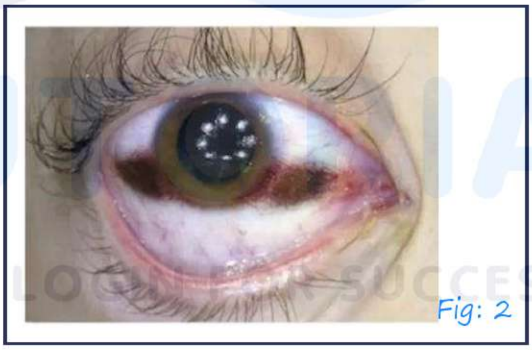

Fig: 2

- After death if eyelids remain opened

  ↓

  Formation of cell debris + deposition of foreign bodies.

  ↓

  Triangular patches on sclera at each side of cornea in 3-4 hrs.

  ↓

  Yellow → dark brown → black

Larcher's sign 00:17:24

- The cornea becomes grey-black, cloudy & wrinkled.

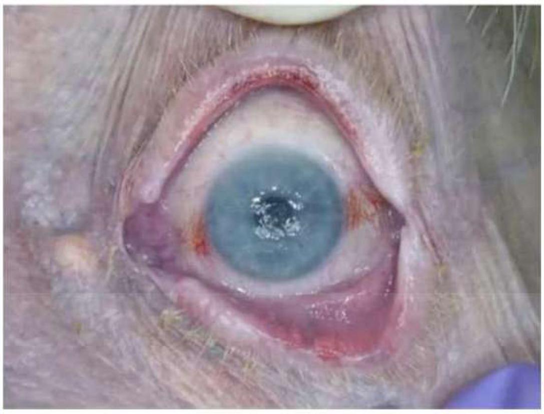

Fig: 3

- About 6 hours after death.

Postmortem cooling = Algor mortis(chill of death) 00:18:00

- After death, the body tries to attain the environment temperature.
- After death, body loose temperature by Conduction, convection and radiation.
- Dead body temperature is recorded by a chemical thermometer, known as thanatometer.
  - The length of chemical thermometer is 25cm.
  - It is graduated from 0°C to 50°C.

0°C
Graduated from
50°C

Fig: 4

- Electronic thermocouple is used to record the dead body temperature and is better.
- Ideal place to record body temp is rectum. But in case of sodomy, the core body temperature is best measured from inferior surface of liver.

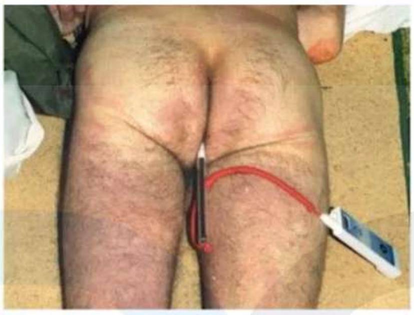

Fig: 5

- Rectal temperature does not appreciably fall till 30-60 mins.
- Cooling of the body shows sigmoid shape of the curve.

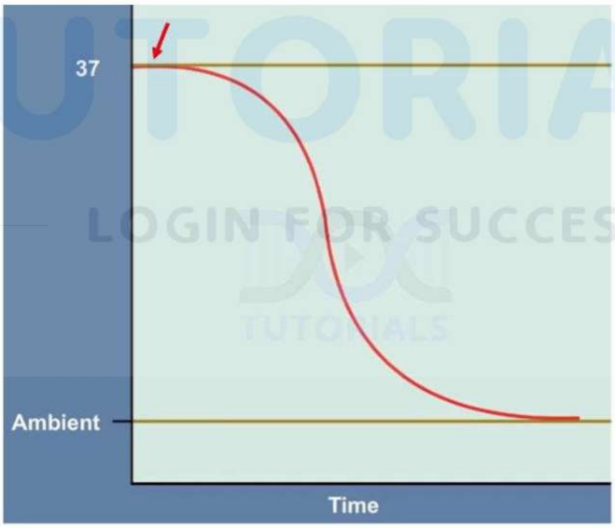

Fig: 6

Time since death 00:23:11

- Time since death = $$\frac{\text{Normal body temp} - \text{Rectal temp}}{\text{Avg. fall/hr } (1.5^\circ F \text{ or } 0.5^\circ C)}$$
- In Delhi, during winter, the fall of temp is $1.5^\circ C$ per hour. (As per Dr. Anil Agrawal's TB)

Postmortem Caloricity 00:25:55

- Temperature of body remains raised after death. May be due to
  i. Disturbance of heat regulation.
    - Sunstroke, pontine hemorrhage.
  ii. Increases production of heat due to muscular activity.
    - Tetanus, strychnine, violent asphyxia deaths (struggle prior death)
  iii. Infections i.e. excessive bacterial activity
    - Septicemia, cholera, influenza etc.
  iv. Miscellaneous:
    - Alcohol, heroin, cocaine and CO poisoning, High atmospheric temperature, drug reactions, fat/air embolism.

Hypostasis/PM lividity/Suggillation 00:29:50

- Also known as PM Staining/lucidity/cogitation/Livor mortis.

- It is bluish red/bluish purple discoloration after death on dependent parts of the body.
- Due to gravity shifting & collecting & blood in capillaries & small veins in superficial layer of dermis.
- Doesn't appear on areas of contact flattening (pressure areas) due to compression of capillaries.

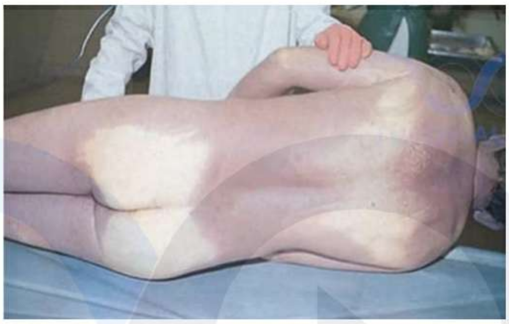

Fig: 7

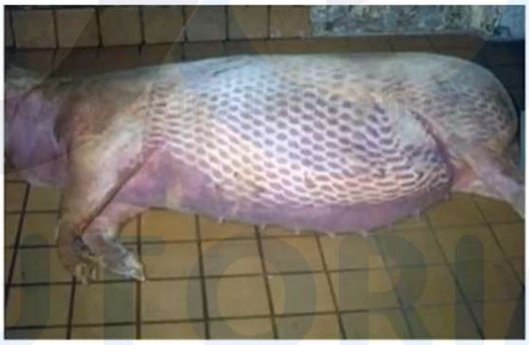

Fig: 8

- It disappears along with the onset of putrefaction.
- If a body is left undisturbed, the postmortem staining persists till it merges with discoloration of putrefaction.
- In a body lying in supine position, the P.M hypostasis first appears in the back of the neck.

Vibices (P.M Ecchymoses, Death spots) 00:35:50

- Extensive confluent skin hemorrhages within the dependent hypostasis.
- Due to increase intravascular hydrostatic pressure.

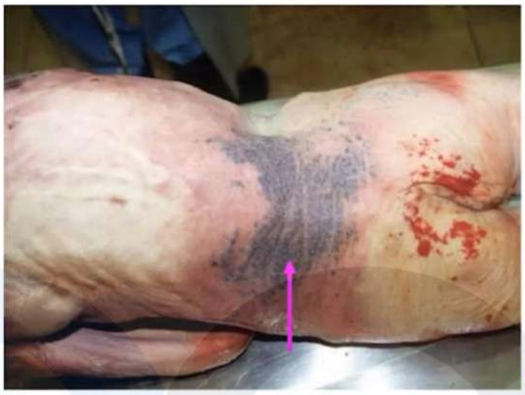

Fig: 9

- Glove & stocking PM lividity
  - Seen in hanging/PM suspension

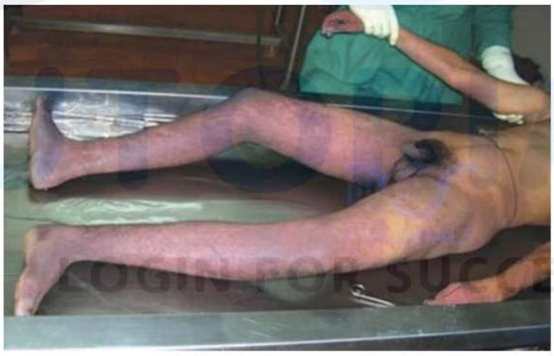

Fig: 10

P.M lividity is absent in 00:37:57

- Bodies in running water.
- Severe anemia (<5g%)
- In case of severe hemorrhage. (>65% of blood loss in adults and .45% in infants)

PM lividity in stagnant water 00:39:38

- Body usually floats face down, buttocks up with limbs hanging down.
- So, seen in face, upper part of the chest, hands & forearm, and feet & legs.

Fig: 11

Colour changes in postmortem 00:40:46

i. Normal → bluish red
ii. CO → Cherry red
iii. Cyanide → Bright red
iv. Hypothermia & refrigerated bodies → Bright pink
v. Phosphorus → Dark brown
vi. Nitrates & Aniline → Reddish brown (sometimes deep blue)

↓

Aniline > Nitrates

vii. H_2S → Bluish green
viii. Cl. perfringens → Bronze
ix. Opium → Black

- Lividity may be seen in agonal period in case of cholera.

Time since death from P.M lividity 00:44:38

- 0 – ½hr → Absent
- ½ to 2hrs → Patches appear
- 2 –4hrs → Patches coalesce
- 4hrs → Well developed
- 6–12hrs → Fixes (Avg. 8hrs)
- Apply pressure over hypostasis for about 30 sec.

  i. If blanches → not fixed → <12 hours.

  ii. If it doesn't blanch → fixed → > 6 hours

Incision Test 00:49:01

- To differentiate bruise form hypostasis.
- Hypostasis → blood is seen within blood vessels which is easily washed away.
- Bruise → Extravasation of blood in surrounding tissue & cannot be washed away.

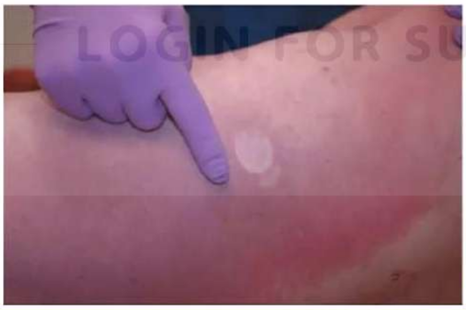

Fig: 12

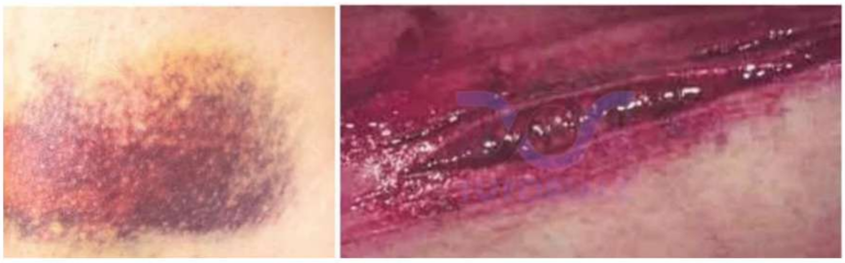

Fig: 13

Other differentiating points:

1. On pressing if you see blanching, it is not a bruise as bruise does not blanch, because there is extravasation of the blood & infiltration of the tissue.
2. Bruises can be seen anywhere over the body whereas hypostasis can be seen only on the dependent part of the body.
3. Margins are blurred in cases of bruises, whereas in hypostasis, margins are well defined.
4. In case of bruise, it may be associated with some abrasion → differences.

Muscle changes after death 00:52:55

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1. Stage of primary flaccidity/relaxation (body length may be more by 2 to 2.5cm) – All the sphincters are relaxed and there may be incontinence of urine, feces and semen.
2. Stage of Rigor mortis
3. Stage of secondary flaccidity/relaxation (d/t putrefaction)

Rigor Mortis 00:54:19

- Also known as Cadaveric rigidity.
- Here, muscles stiffen & shorten.
- It is due to the depletion of ATP.

- Rigor mortis starts when ATP level reaches less than 85% of normal (i.e., 15% depletion).
- Rigor mortis reaches its peak when ATP level reaches less than 15% of normal (i.e., 85% depletion).
- During rigor mortis, lactic acid level is 0.3%.
- Rigor mortis involves all the muscles.
- Rigor mortis is not seen in a foetus < 7 months*.

  [* if '< 8 weeks' is given in option, then opt for that option (Dr. Anil Aggrawal)
- Rigor mortis first occurs in heart (overall); Externally → Upper eyelid.
- Rigor mortis follows Nysten's law, i.e., proximodistal progression. The order of Rigor mortis is: eyelids, neck & lower jaw, face, chest, upper limbs, abdomen, lower limbs & fingers & toes.
- Rigor mortis follows rule of 12, i.e.,

  It takes 12hrs → to establish

  12hrs → Persists

  12hrs → passes off.
- The rigor mortis disappears in the same pattern as it is established (proximodistal regression), i.e., It first disappears in eyelids, then the neck & lower jaw, face, chest, upper limb, abdomen, lower limbs & fingers & toes.
- RM sets earlier in summer than winter.
- Cutis anserina of rigor mortis is due to the stiffness of erector pilorum.

Fig: 14

Appearance of rigor mortis and duration:

- Faster onset in: (because of more surface area)
  - Children
  - Elderly
  - Malnourished individuals
- Delayed onset in:
  - Severe haemorrhage
  - Pneumonia
  - Apoplexy
  - Deaths from non-violent asphyxia deaths
  - Nervous diseases causing paralysis of muscles
- Early onset and short duration in:
  1. Death from disease causing great exhaustion and wasting
     - Cholera, typhoid, TB, cancer etc.
  2. Violent deaths
     - Cut-throat, firearm, electrocution, lightening, heat stroke etc.
  3. Death preceded by convulsions
     - DDT, OP, Strychnine, Tetanus
- Rigor mortis is frequently absent in septicemia.

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- In strychnine poisoning rigor mortis starts early & passes of quickly
- In pneumonia, RM starts late.
- In arsenic poisoning, RM starts late and persists for longer time.
- Rigor mortis is frequently absent in septicemia.
- In view of wide range of times at which the various stages of rigor mortis appear & fade, it is a poor determinant of time since death, compared with estimations of body temperature.

Sommer's movement 01:09:11

- Change in the position of limbs due to rigor mortis is known as summer's movement.

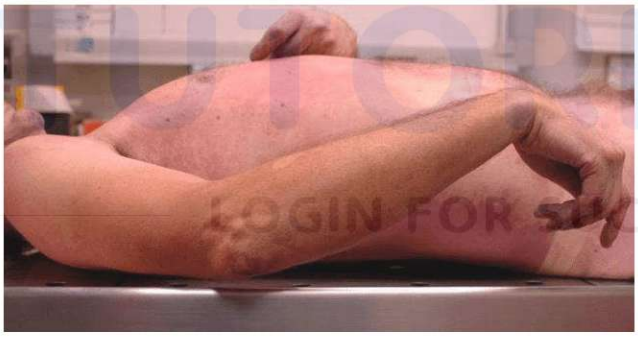

Fig: 15

Conditions stimulating Rigor mortis 01:09:57

i. Heat stiffening
  - Pugilistic attitude

Fig: 16

ii. Cold stiffening → Ice formation → Body becomes rigid & stiff.

iii. Cadaveric spasm → AKA, Instantaneous rigor, or Cataleptic rigidity.

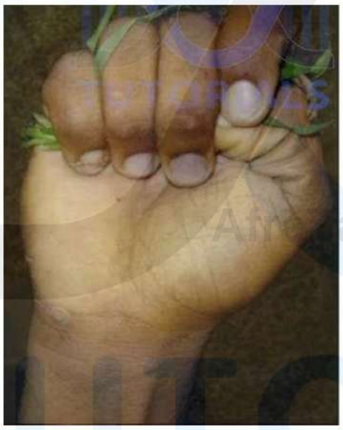

Fig: 17

- The conditions required are sudden death, great emotional tension, and muscular activity at the time of death.
- Generally, involves only certain groups of voluntary muscles
- Usually seen in hands (Death clutch)

iv. Gas stiffening (?) → Putrefaction.

v. Embalming → Fixation of tissue.

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THANATOLOGY PART – II

Decomposition 00:00:16

Decomposition involves

a. Autolysis

- Due to enzymes (lysosomes)
- Whitish cloudy appearance in the cornea is the 1st external sign of decomposition.

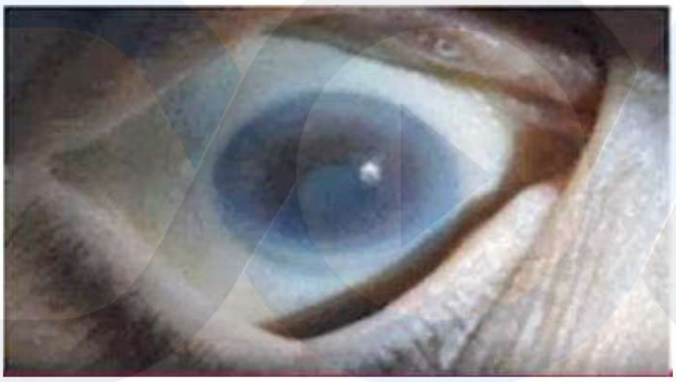


Fig: 1

b. Putrefaction

- Due to bacteria.

Chief agent of putrefaction 00:01:41

Cl. perfringens (Cl. welchi)

- It liberates lecithinase that breaks the cell wall and cause hemolysis.
- Meanwhile, at the process of putrefaction it liberates H_2S (combustible gas), which combines with haemoglobin and forms sulphmethaemoglobin which

is responsible for greenish disclouration of putrefaction

- Putrefaction begine abouve 10°C and optimum between 21°C and 38°C
- Putrefactive gases are ammonia, CO, CO_2, H_2S, Phosphorated hydrogen, Methane, Mercaptans.

Foamy/Honey comb liver 00:04:49

- During putrefaction, gases collect in the parenchyma of liver.
- On cut section, it shows honey comb appearance.

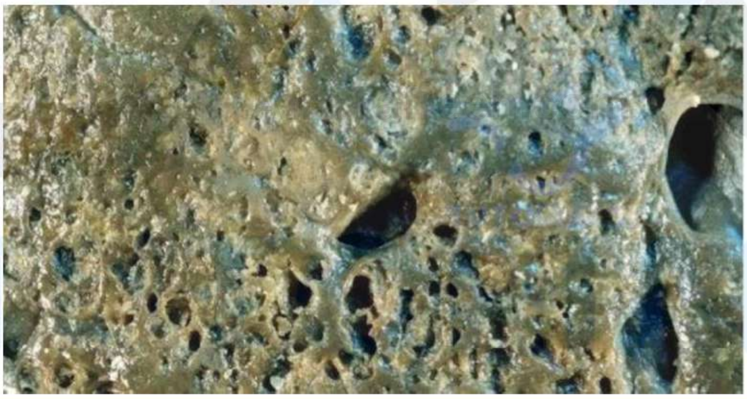


Fig: 2

Putrefaction 00:06:16

- 1st external sign → Greenish discoloration in right iliac fossa.
  - In summer → 18 hrs
  - In winter → 36 hrs

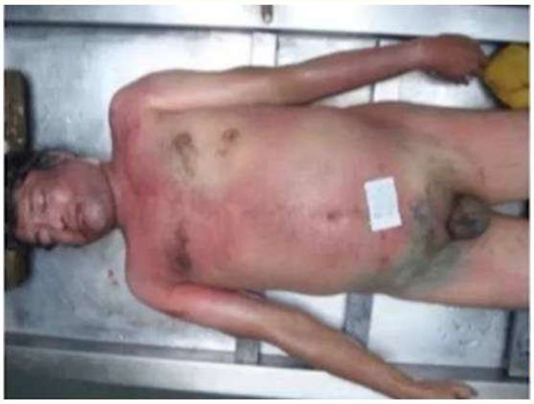


Fig: 3

- 1st Internal sign

  i. Reddish brown discolouration in intima of aorta.

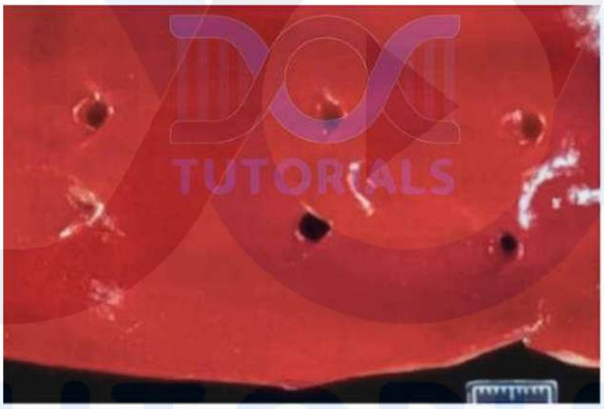


Fig: 4

  ii. Greenish discolouration of under surface of liver.

  (Aorta > Liver)

Order of Putrefaction 00:08:32

Larynx and Trachea

↓

Stomach, intestine → spleen

↓

Liver → Brain → Heart → Lungs

↓

Kidney → Bladder → Esophagus → Pancreas

↓

Skin, Muscle, Tendon

↓

Prostate, Non-gravid uterus

↓

Bone

↓

Teeth

Order of Putrefaction (Externally) 00:11:26

- In air: Abdomen → Chest → Face & Neck → lower limbs → Upper limbs
- In water: Face & Neck → Chest → Upper limbs → Abdomen → Lower limbs.

Marbling 00:12:33

- It is due to staining of walls of superficial veins by sulphmethaemoglobin (Initially red, then greenish)
- Commences in about 24 hrs, becomes prominent in 36-48 hrs.
- Seen most clearly on the thighs, sides of the abdomen and chest & shoulders.

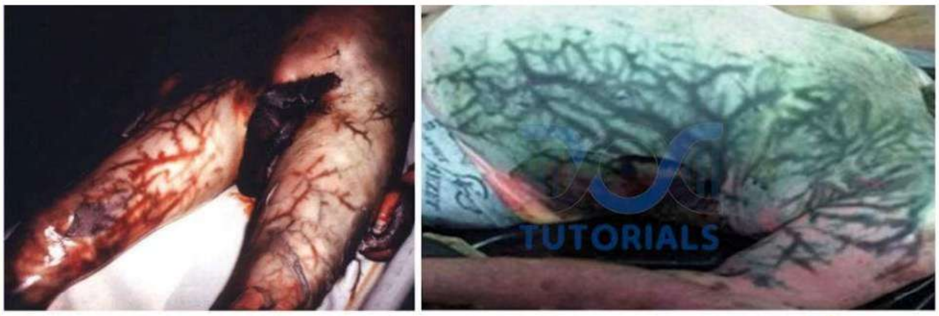


Fig: 5

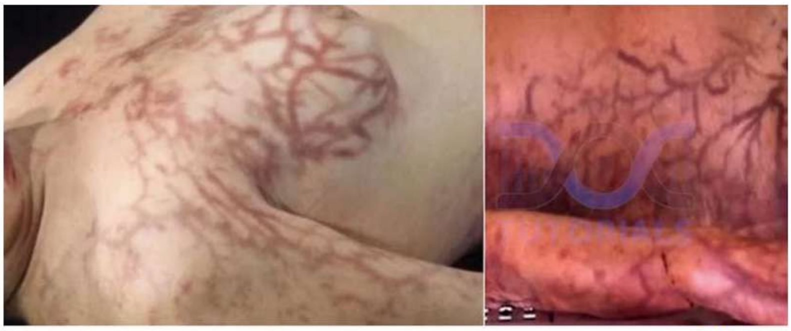


Fig: 6

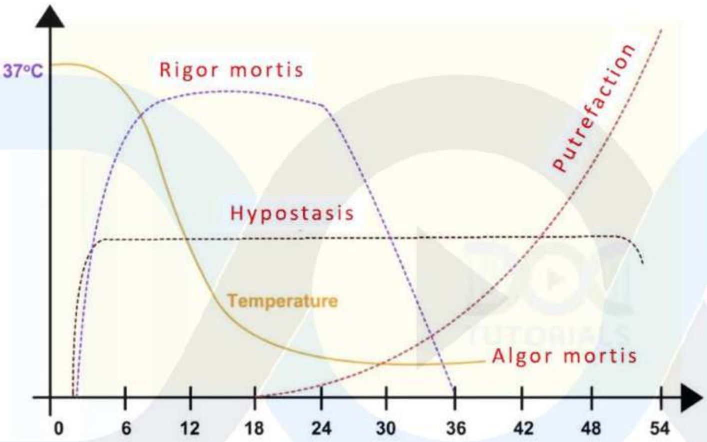


Fig: 7

PM Purge 00:17:54

- Purging of blood-stained froth/gastric contents from the mouth and nostrils.
- Due to pressure by putrefactive gases.

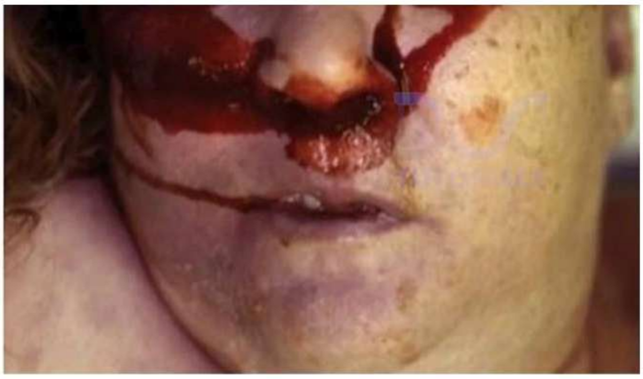


Fig: 8

Coffin birth 00:18:25

- Postmortem delivery → due to pressure by putrefactive gases.

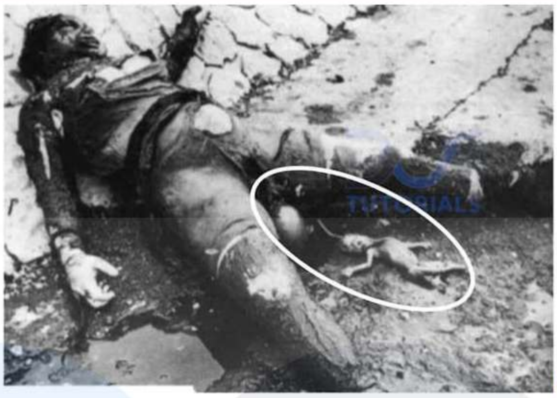


Fig: 9

Pink Teeth 00:18:50

- It is due to the seepage of hemoglobin or it's derivatives (protoporphyrin) into dentinal tubules.
- Seen in about 1-2 wks after death.
- Usually associated with water immersion.
- It is not related to cause of death.

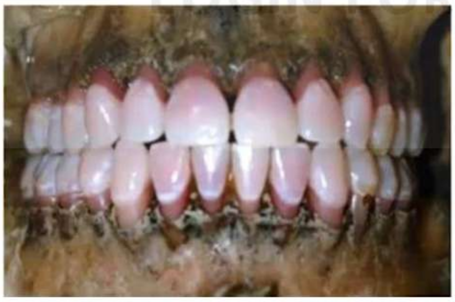


Fig: 10

- Postmortem luminescence is due to photobacterium fischeri(bacteria) or Armillaria mellea (luminescent fungi).

  - It is mainly caused by photobacterium fischeri.

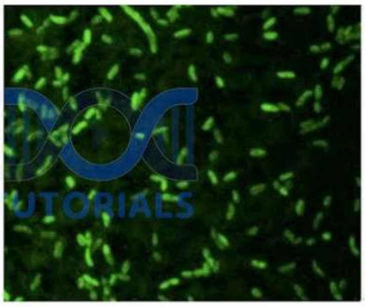


Fig: 11

- Colliquative putrefaction is seen in 5-10 days after death.

Casper's dictum 00:21:31

- It helps in the determination of rate of putrefaction.
- If the environmental factors are same, a body decomposes in air twice as rapidly in water and 8 times as rapidly as in earth.

  Air: Water: Earth → 1:2:8

  - In a dead body hair becomes loose after 72 hrs.
  - Growth of the beard is 0.4 mm/day
  - Growth of scalp hair is 3mm/week
  - Nail grows 0.1 mm/day.
  - Evaluation of urine content of urinary bladder could help in estimating the time of death.

Forensic Entomology 00:25:36

- Study of insects and their role in administration of justice is forensic entomology.

  Flies

↓ Minutes (Summer) – Hours (Winter/Rainy Season)

Eggs

↓ 8hrs (s) – 24 hrs (W/RS)

Maggots/ Larvae

↓ 5 days (S) – 15 days (W/RS)

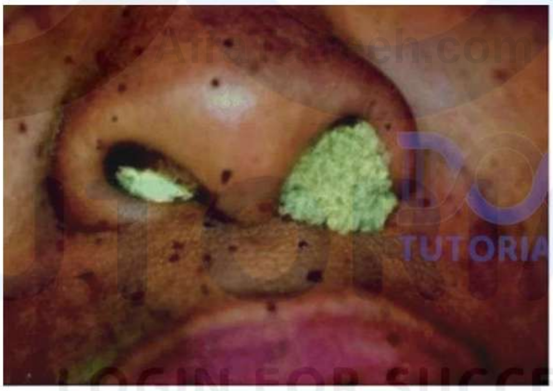
Pupae

↓ 5 days (S & W)

Nymph (Newborn fly)

Total → 10/11 days (s) to 22 days (W)

- Time since death by life cycle of the insects is estimated by **Pradhan's formula**



Eggs Fig: 12

Maggots Fig: 13

Pupae

Fig: 14

Fig: 15

- Forensic entomology helps in determining
  - Time since death
  - Place of death and
  - Cause of death

Modification of Putrefaction 00:30:40

- Sometimes, the process of putrefaction may get arrested and may go into the following change.

  1.Adipocere/Saponification/Grave wax

    (Rancid/sweetish odour)

    - Three conditions are required
      a. Moisture
      b. Warm temperature
      c. Less air

- Gives a rancid odor.

2. Mummification
   - Three conditions are required
     a. No moisture
     b. High temperature
     c. Free flow of air
   - It is odorless.

Adipocere 00:33:49

- Here, the body fat is converted into higher fatty acids → Palmitic acid (main constituent), Stearic acid, Hydroxy stearic acid and Oleic acid by Cl. Welchi which liberates lecithinase.
- Adipocere does not form in a foetus < 7 months.
- It starts early in fat depots of the body, i.e., Face, breast, abdomen and buttocks.

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Features in Adipocere 00:35:40

- Facial features are well preserved.

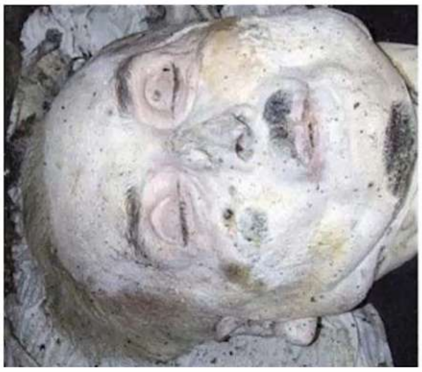

Fig: 16

Features in Mummification 00:36:07

- General facial features are preserved.

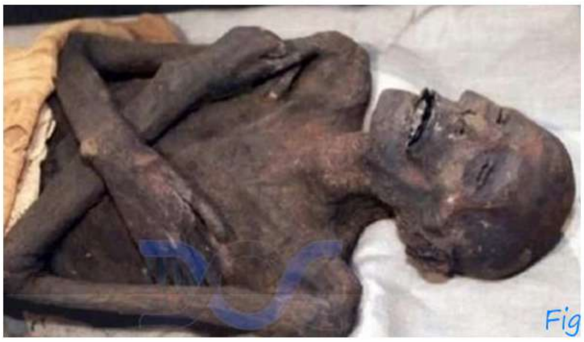
Fig: 17

Medicoleagal importance:

1.Identification

2.Cause of death

3.Time since death

4.Place of death

- In mummification, the entire body loses weight up to 60-70%

Extra edge topics 00:39:44

- The pupils react to atropine and eserine for about an hour after death
- Lazarus syndrome
  - The phenomenon of person returning to life after suspended animation
- Glistening of cornea even after death is seen in:
  - CO and Cyanide poisoning
- Dimness of cornea before death is seen in:
  - Cholera

- Uraemia
- Narcotic poisoning
- Wasting disease

- **sudden death**
  - Means, when a person not known to have been suffering from
  - a dangerous disease, injury or poisoning
  - is found dead or dies
  - within 24 hours after the onset of terminal illness
- **For cadaveric transplantation:**
  - Cornea can be removed from a dead body within 6 hours
  - Skin in 24 hours
  - Bone in 48 hours and
  - Blood vessels in 72 hours
- **Livid patches may be seen even before death** in the agonal period in case of
  - Cholera
  - Typhus
  - TB
  - Uremia
  - Morphine and Barbiturate poisoning
  - CCF
  - Deep coma and
  - Asphyxial deaths

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Conditions which retard/delays putrefaction:

- Wasting disease:
- Anemia & severe hemorrhage (decreased blood)
- Debility (Atrophy of tissue)
- Poisons:
- Arsenic, antimony and other heavy metals, carbolic acid, zinc chloride, strychnine

Poisons which resist putrefaction:

- CO, cyanide, fluoride, barbiturates, P, OP, endrin, strychnine, yellow oleander, nicotine, etc.
- Heavy metals
- Arsenic, antimony, mercury, lead, thallium etc.
- **Decomposition of bone:**
- Bones decompose after death in 3-10 years
- Less than 7 amino acids in bone means, the time since death is more than 100 years
- First Amino acid to disappear is Proline and Hydroxy-Proline
- Last Amino acid to disappear is Glycine

Postmortem Chemistry

- Blood: ↓ Glucose, Na^+, Cl^-
- C.S.F.: ↓ Glucose. No change in Urea, Creatinine, Na^+, Ca^{++} and Mg^{++}
- V. Humor: ↓ Glucose, Na^+, Pyruvic acid
- All other parameters increase after death

K^+ level in vitreous humor

- ↑ after death up to 100 hours after death
- Time since death is estimated by
- Madea's and Hensge's formula
- Sturner's equation

Tests for circulation (Obsolete)

1. Diaphanus test (Transillumination test):
   - Hands with closed fingers are held against the strong source of light
   - During life, it appears red and translucent; After death, it is yellow and opaque.
2. Icard's dye test:
   - Fluorescein dye on being injected at a given site in a dead body fail to produce yellowish-green discoloration as seen in a living person.
3. Magnus test:
   - Ligature applied to finger. It swells and becomes blue if the person is alive
4. Fingernail test:
   - Pressure is applied to the nail bed, during life nail bed is red and on pressure it turns pale. After death, remains pale throughout.

Tests for respiration (Obsolete)

1. Winslow's test:

- No movement of reflection of light shone on mirror or surface of water in bowl kept on the chest.

2.Feather test:

- No movement is seen, if a feather or fie cotton fibers are held before the nostrils.

3.Mirror test:

- No haziness is seen on the reflecting surface of the mirror held in front of mouth and nostrils.

MECHANICAL INJURIES

- Mechanical injuries means the injuries cause by physical force.

Abrasion 00:00:20

- It is the most common type of mechanical injury.
- It is a superficial injury involving only the epidermis loss.
- No scar formation.
- Margins are well defined.
- Usually, cannot be a grievous hurt.
  - Exception: corneal abrasion

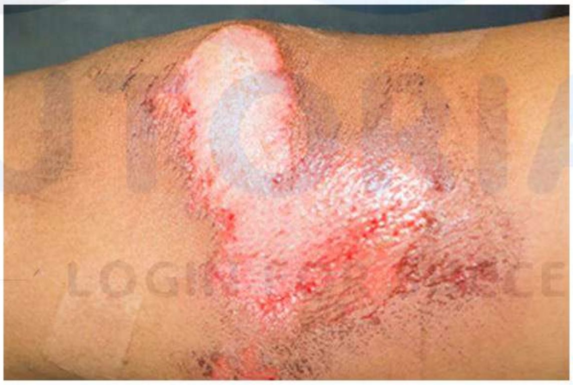

Fig: 1

Types of abrasion 00:02:50

Scratch abrasion

- Caused by pin, thorn, nail or any pointed objects.
- Heaped up epithelium on termination → direction of force

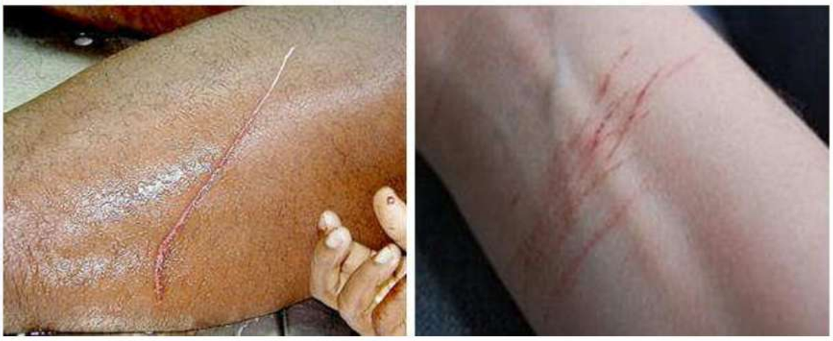

Fig: 2

Grazes (sliding/scraping/grinding abrasion)

- It is caused by broad rough surface.
- Most commonly seen in RTA/Fall.
- Most common type of abrasion.

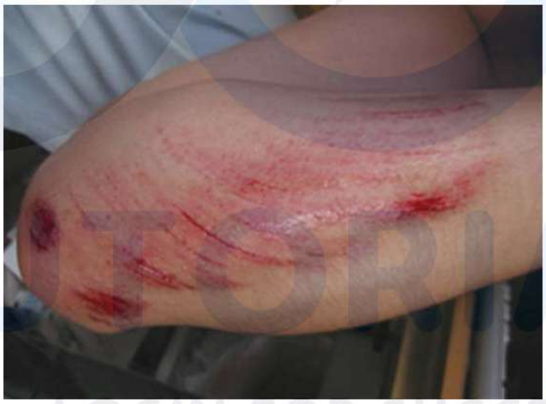

Fig: 3

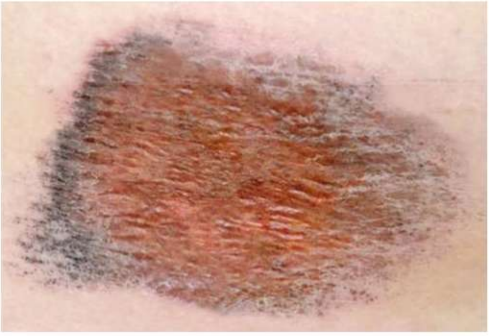

Fig: 4

- Dragging on a rough ground → Brush burn/friction burn/gravel rash scuff abrasion

- Rope burn is an example of graze abrasion

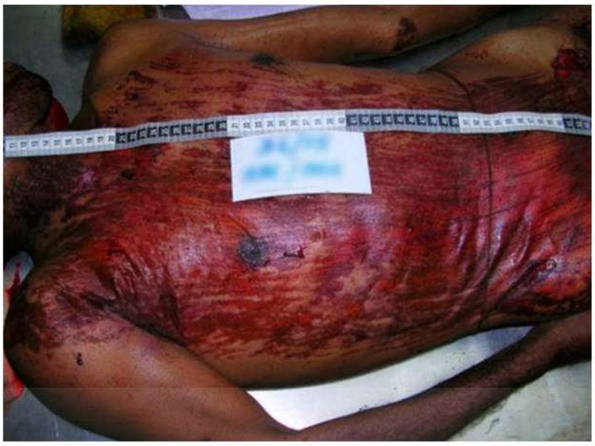

Fig: 5

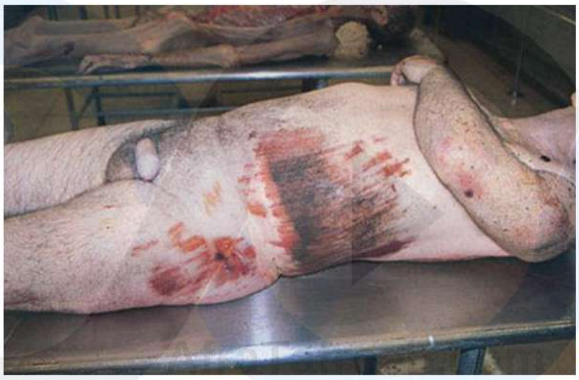

Fig: 6

Impact abrasion/imprint/contact abrasion

- It is due to momentary impact
- Example: Tyre tread marks, radiator grill marks

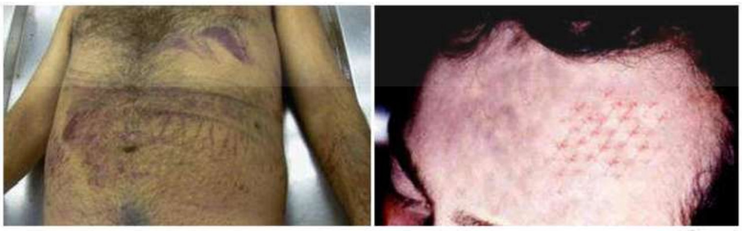

Fig: 7

Pressure abrasion (crushing/ friction abrasion)

- It is due to sustained pressure.
- Example: Ligature mark

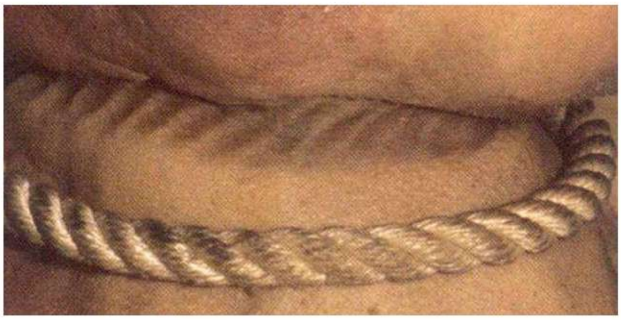

Fig: 8

- Whether it is imprint abrasion or pressure abrasion, if it gives rise to a pattern of the causative object, then it is known as patterned abrasion → **Best term to use**

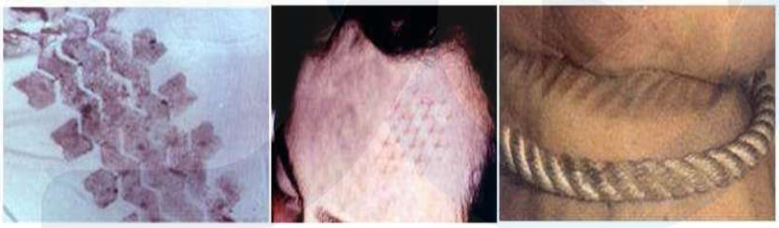

Fig: 9

Age of abrasion 00:10:31

- Fresh → Bright red

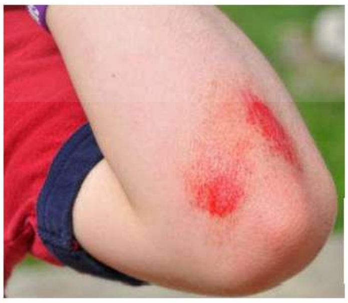

Fig: 10

- 1 day → Lymph & blood dries up leaving a bright red scab.

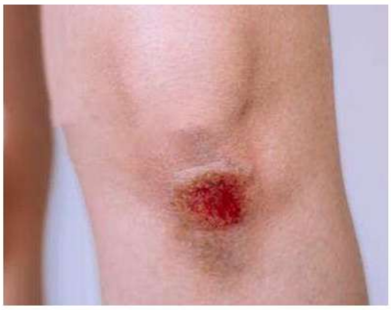

Fig: 11

- 2-3 days → Reddish-brown scab

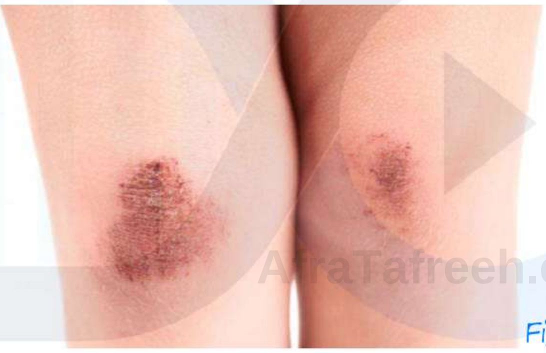

Fig: 12

- 4-7 days →dark brown to brownish-black scab. Epithelium grows and covers defect under the scab.

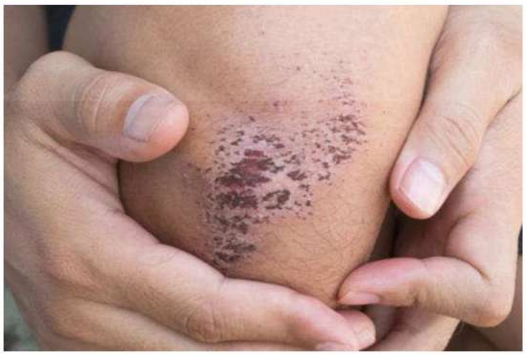

Fig: 13

- After 7 days → Scab dries, shrinks and falls off

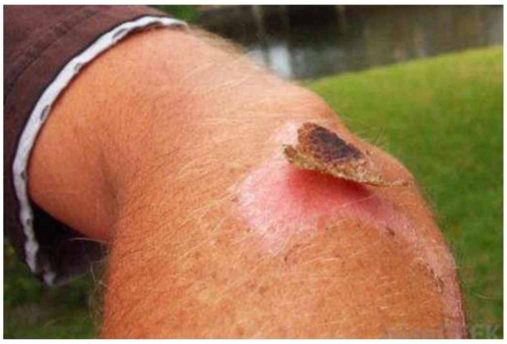

Fig: 14

Antemortem abrasions can be confused with ant bite marks.

Bruises 00:12:57

- Caused by blunt force.
- Effusion of blood into the tissue underneath the skin.
- Rupture of arterioles, venules & veins.
- Skin is intact.
- Margins are blurred.
- Colour is lighter in centre than at the periphery.

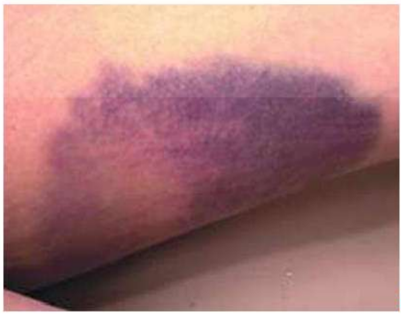

Fig: 15

Size of bruises 00:14:54

- 0.1-2mm → Petechial haemorrhages

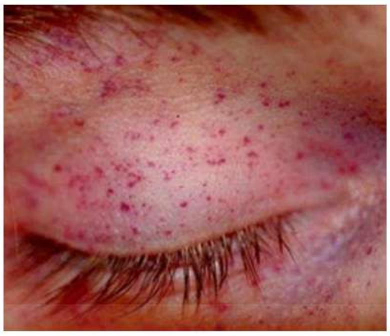

Fig: 16

- 2-5mm → Ecchymoses

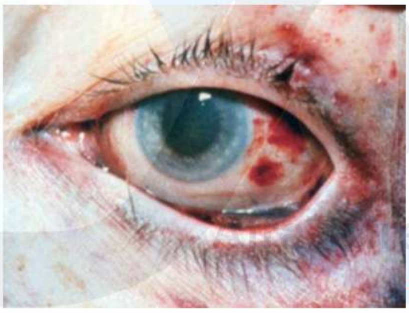

Fig: 17

- >5mm → Bruise

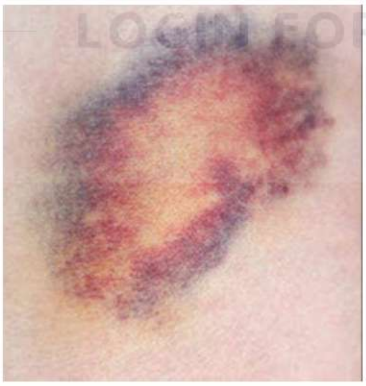

Fig: 18

Contusion

- Effusion of blood into other tissues/organs.

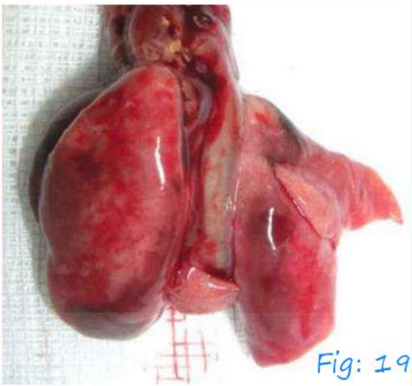

Fig: 19

Age of bruises 00:16:24

- Fresh → Red → oxy Hb

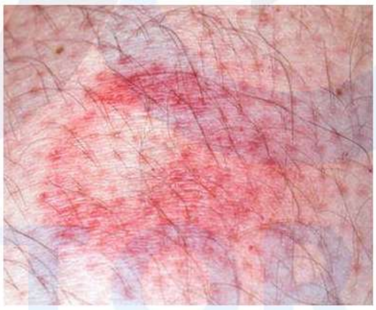

Fig: 20

- In few hours – 3 days → Blue → Deoxy Hb

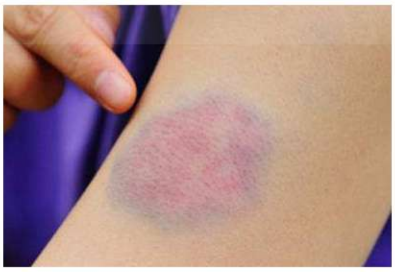

Fig: 21

Colour changes begin from the periphery

- 4th day → Bluish black to brown → hemosiderin

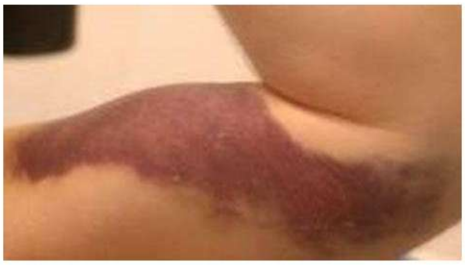

Fig: 22

- 5-6 days → Green → Hematoidin

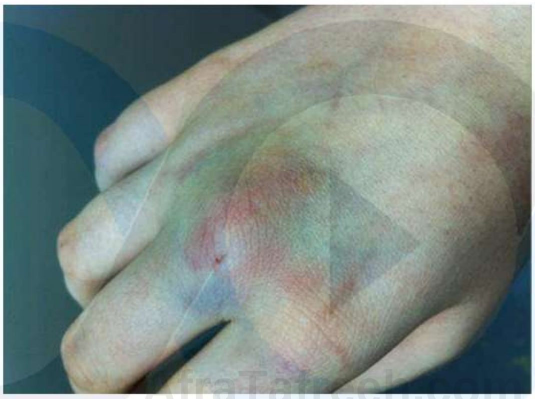

Fig: 23

- 7-12 days → Yellow → Bilirubin

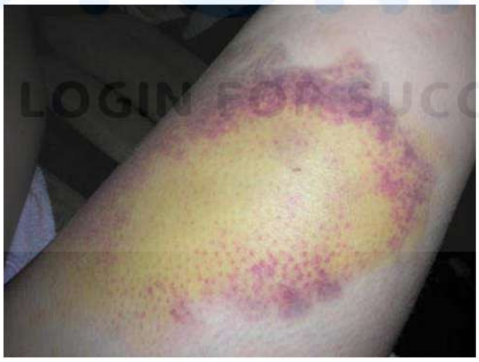

Fig: 24

- 2 weeks → Normal
- Exception → Sub conjunctional haemorrhage → Red to yellow (Due to diffusion of atmospheric O_2)

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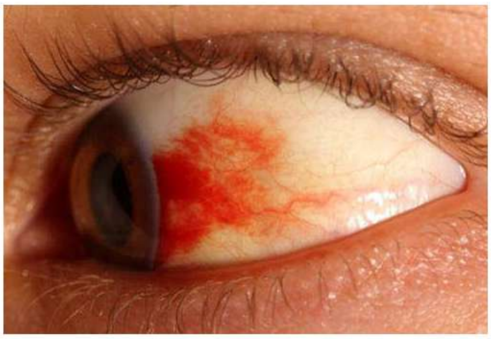

Fig: 25

Duration	Color	Reason
Fresh	Red	Oxy Hb
Few hours to few days	Blue	Deoxy Hb
4th day	Bluish black to brown	Hemosiderin
5-6day	Green	Hematoidin
7-12 days	Yellow	Bilirubin
2weeks	Normal	-

Classification of bruises 00:19:42

- Intradermal
- Subcutaneous → Most common
- Deep (May not appear immediately)
  - Examination
    - a. By IR photography
    - b. After 48hours
- A lesser impact causes maximum bruise over face due to high vascularity.
- Bruise over scalp is better felt than seen.

Ectopic/Percolated/Migratory bruises 00:21:47

- Bruises present at areas other than at the area of impact
  - Example:
    i. Impact over forehead (1) or fracture of Anterior Cranial Fossa (2) May cause black eye

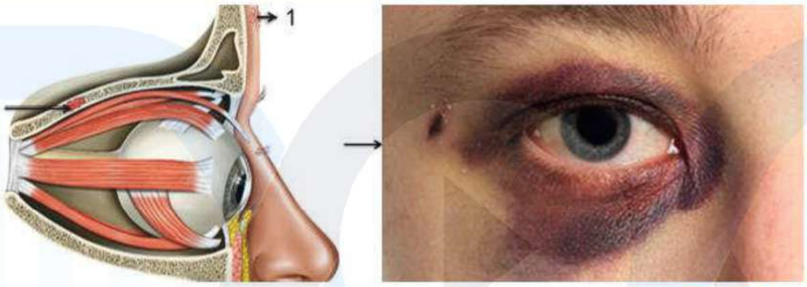

Fig: 26

ii. Battle's sign → Fracture of middle cranial fossa may give reddish or purplish discolouration over the mastoid

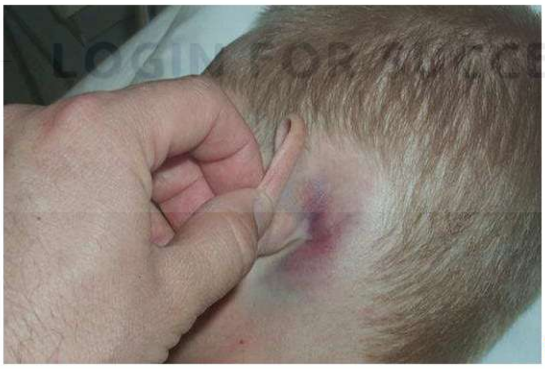

Fig: 27

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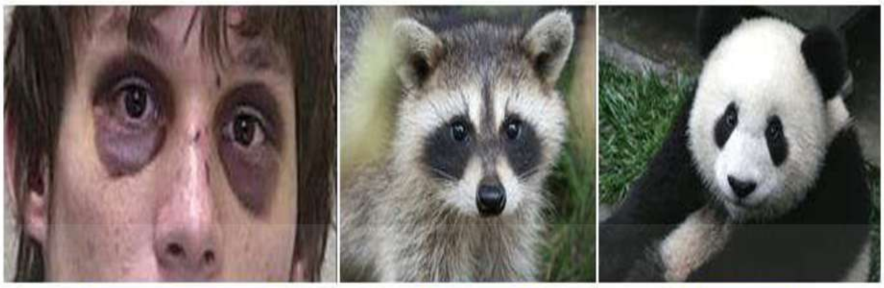
Bilateral black eye

- It is known as spectacle hematoma/Raccoon eye/Panda eye.



Spectacle hematoma Racoon eye Panda eye Fig: 28

Tram/Railway line bruises 00:25:05

- 2 linear parallel bruises with a central pale area.
- Seen in cases of Impact by cane, lathi, rod, stick, pipe etc

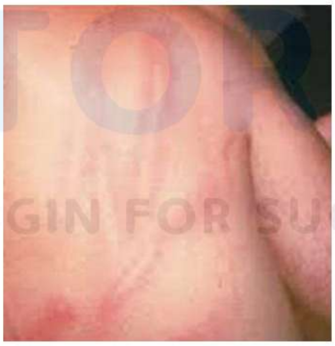


Fig: 29

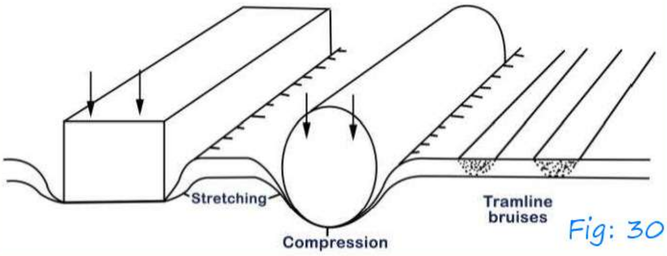

Stretching
Compression
Tramline bruises

Fig: 30

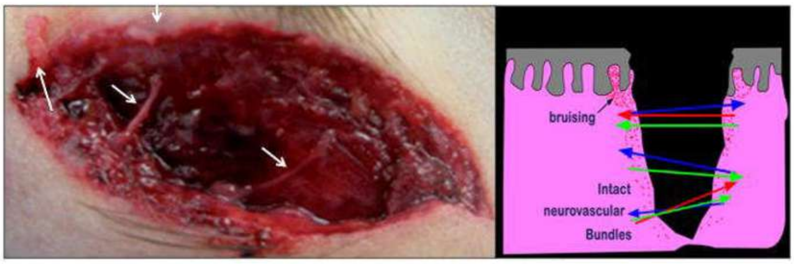
- Stomping → Kicking and jumping on a person.

Difference between lacerated wound, incised wound, chop wound and Heat rupture/fissure

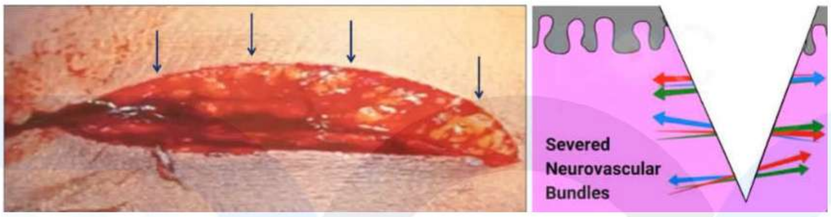
00:27:59

Trait	**Lacerated wound**	**Incised wound**	**Chop wound**	**Heat rupture/ fissure**
Margins	Irregular	Regular	Regular	Irregular
Edges	Abraded/ contused	Not contused	Contused/ abraded	Not contused
Neuro-vascular bundles (Tissue bridges)	Intact	Not intact	Not intact	Intact

Lacerated wound


bruising
Intact
neurovascular
Bundles

Incised wound


Severed
Neurovascular
Bundles

Chop wound

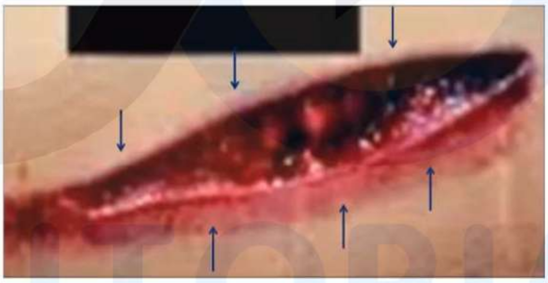


Fig: 31

Chop wound

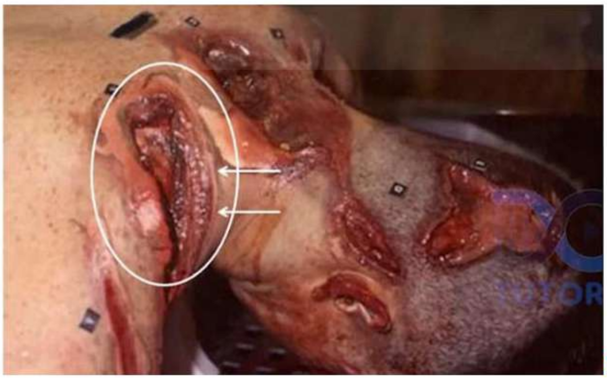


Fig: 32

Heat rupture

- Due to splitting of soft parts.
- Usually seen over extensor surface & joints, calves and head

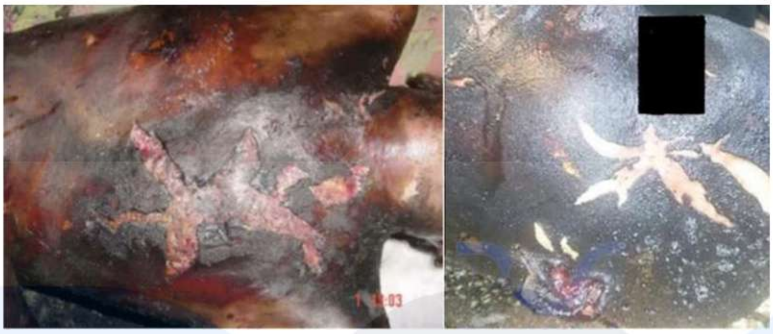

[redacted]

Fig: 33

Lacerations 00:39:32

- Caused by blunt force.
- Tear in the skin & underlying tissue.

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Classification/ types of laceration 00:40:20

Split/Incised looking lacerated wounds

- Caused by perpendicular force.
- Seen over areas where the skin is underlined by bone.
  - Example: Over the Scalp, check, bridge & nose, chin, shin, iliac crest etc.

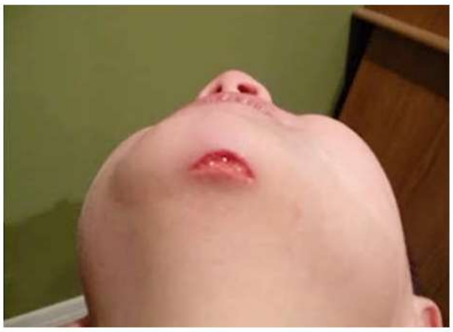


Fig: 34

Stretch laceration

- Caused by tangential/oblique force.

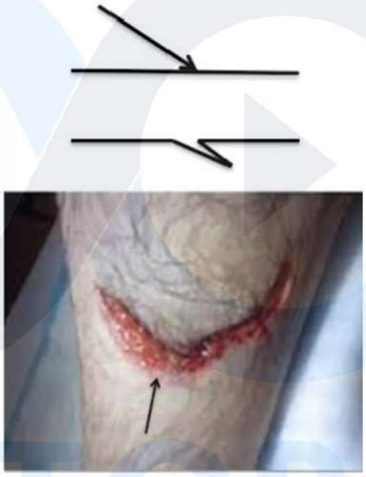


Fig: 35

Avulsion/Degloving/Flaying/Shearing laceration

- Caused by almost horizontal force.

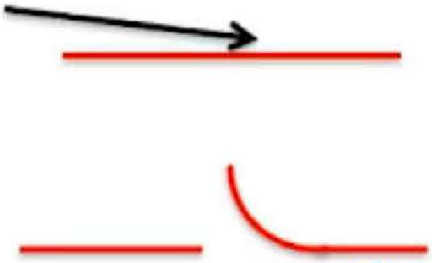


Fig: 36

- Skin is usually avulsed along with subcutaneous tissue.

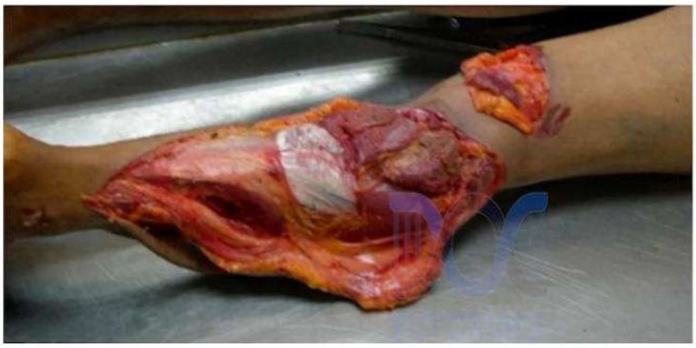


Fig: 37

Tear

- It is caused by irregular force. Eg: fall on broken earthenware pot, multiple stones etc.

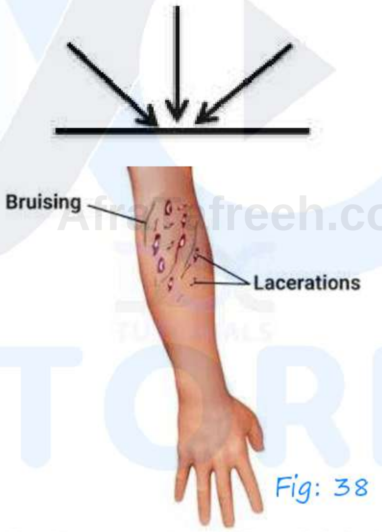


Fig: 38

Crush laceration

- Caused by crushing of tissue as in case of vehicular runover, machineries etc.

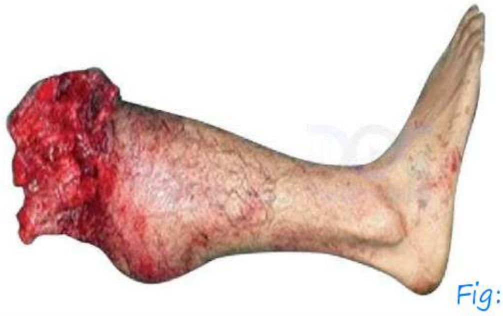


Fig: 39

Swallow tail

- Tearing at the ends, at angles diverging from the main one.

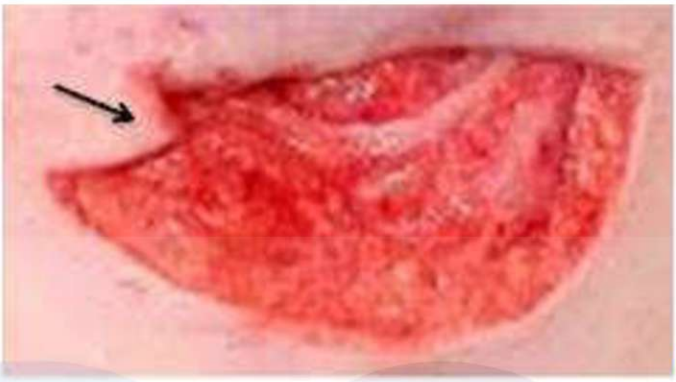


Fig: 40

Incised wound/cuts/slices

- Caused by sharp cutting light weapon, when drawn across the skin.
- Length is the greatest dimension.

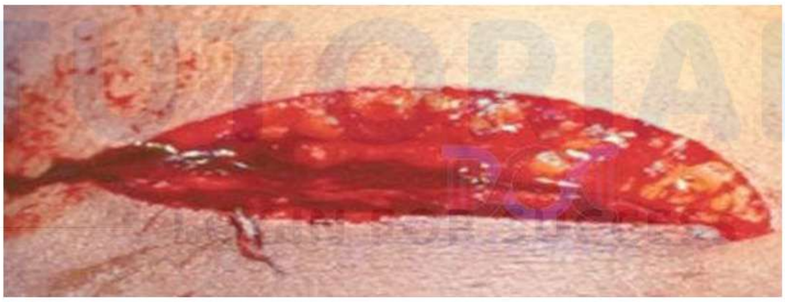


Fig: 41

Lacerated looking incised wounds

- Seen over loose & wrinkled areas of the body such as scrotum, axilla, neck and back of the elbow.

Bevelling cut

- Caused by tangential force

- One margin is undermined
- It is a feature of homicide

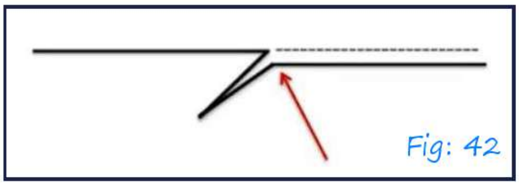


Fig: 42

Flap wound

- Caused by horizontal force

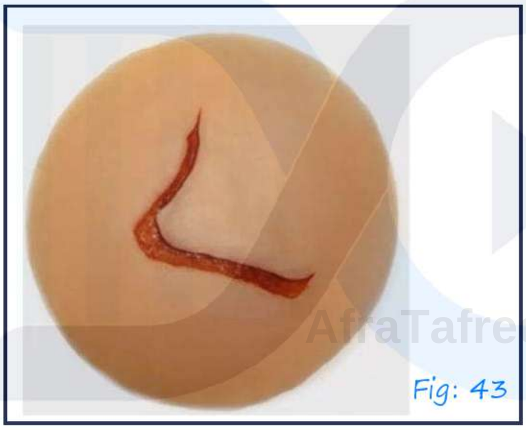


Fig: 43

Tailing

- It indicates the direction

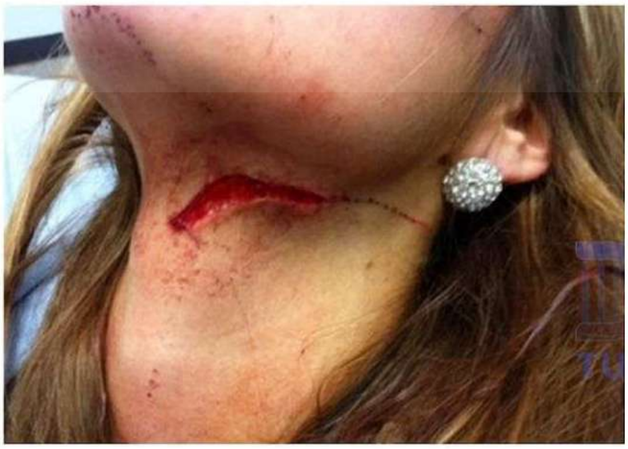


Fig: 44

- In case of suicidal cut wrist injuries, the ulnar nerve may escape injury → due to tailing

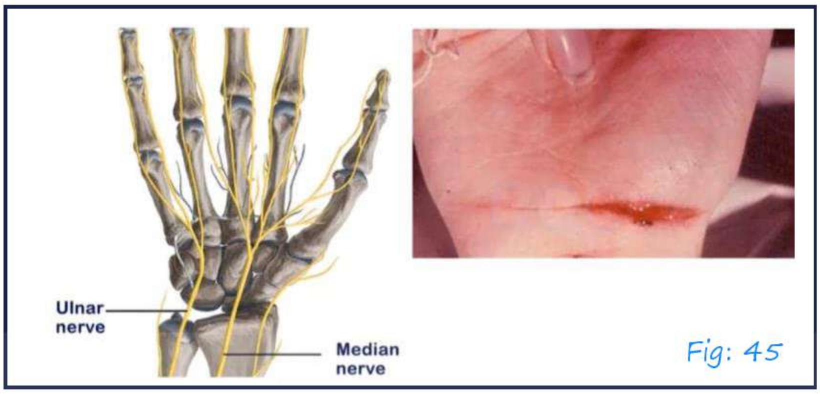


Fig: 45

Hesitation cuts/tentative cuts/trail cuts/exploratory marks

- It is suicidal in nature.

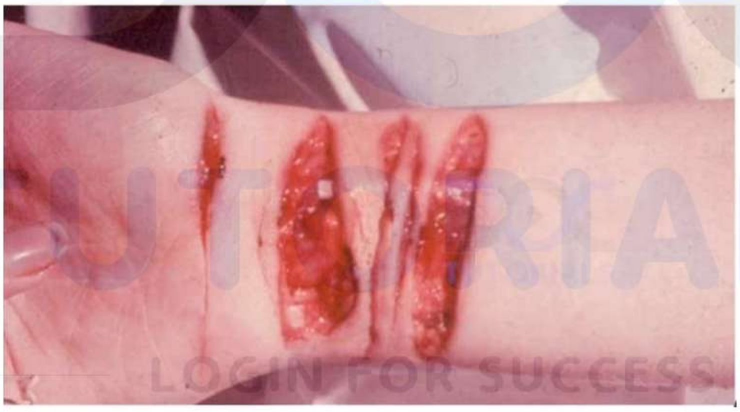


Fig: 46

- Incisional wound on genital is seen commonly in sexual jealous crimes. It is commonly seen in homicides.

Bobbitt syndrome

- Cutting of the external genital of male sexual partner

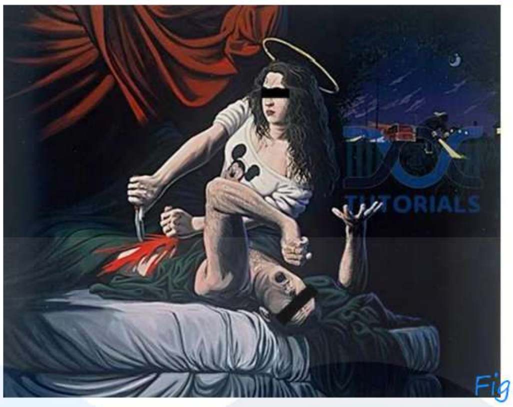


Fig: 47

- It is homicidal

Glasgow smile

- Also known as Glasgow grin, Anna grin, Chelsea grin or Chelsea smile
- Slashing a person's face from the edges of the mouth to ears ("Buck 50" injury)
- It requires approximately 150 stitches to close

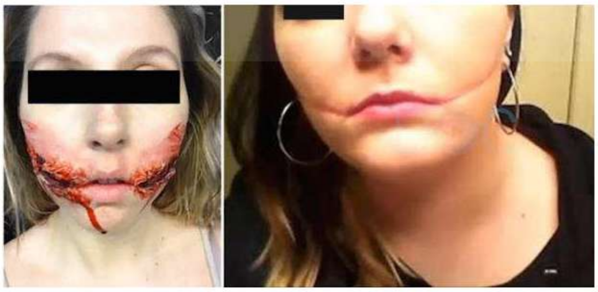


Fig: 48

Parasuicide

- In FMT → Self harm → most common: Poisoning/Drug ingestion

- In Psychiatry → Self-mutilation → Most common: Wrist cutting

Stab wounds 01:03:08

- Caused by pointed weapons
- Depth is the greatest dimension

Fig: 49

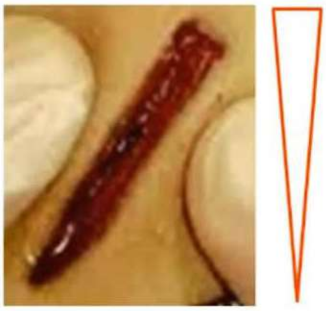
Shape of stab wounds

- It depends on edge, width & size of the blade; but mainly due to the edge of the blade
- Skin is more resistant to knife penetration than subcutaneous tissue, muscle & uncalcified cartilages

i. Single edged knife (kitchen knife)

- They cause triangular/wedge shaped wound of entry

Triangular/wedge



or

Sometimes tear drop shaped/rain drop shaped

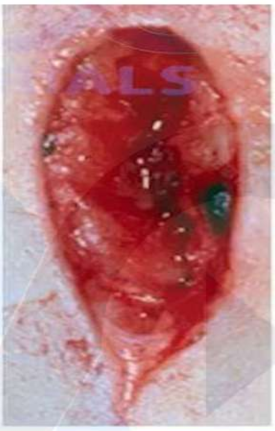


Fig: 50

Fish tailing

- Sometimes, the blunt edge of single edged knife (e.g., kitchen knife) may tear the skin in the shape of the tail of the fish, known as fish tailing.

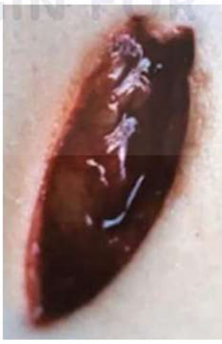


Fig: 51

ii. Double edged knife (Dagger)

- Gives rise to spindle shaped wound.

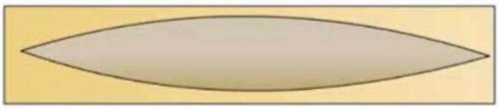


Fig: 52

iii. Blunt pointed weapons (Iron rod/screwdriver etc.)

- Stellate/cruciate shaped wound.

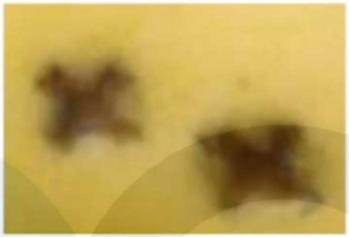


Fig: 53

Ice pick

- Wound will be circular

Heart shaped stab wounds

- May be caused by the dynamic movement of assailant, victim & knife.

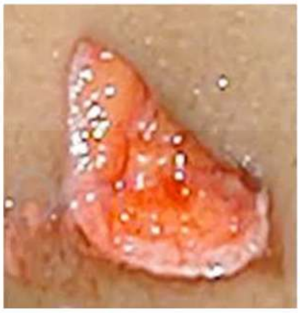


Fig: 54

- Depth may be more than the length of the blade in case of stab wounds over the abdomen due to yielding of the abdomen.

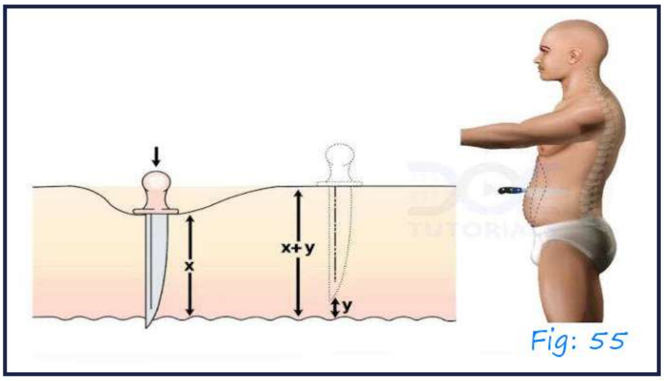


Fig: 55

Vendetta murder

- Overkilling/grudge murder/revenge murder

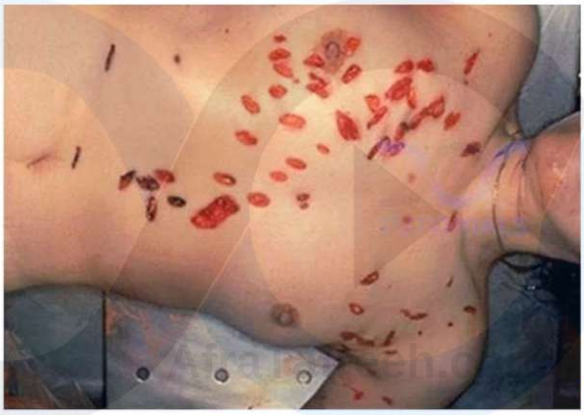


Fig: 56

Types of stab wounds

- A stab may enter into
  - Cavity → penetrated
    - i. Incised penetrated
    - ii. Lacerated penetrated
  - Other than cavity → punctured
    - i. Incised punctured
    - ii. Lacerated punctured
  - Entry & exit → perforated
    - i. Incised perforated
    - ii. Lacerated perforated

- Exception: Penetrating injury to neck → violation of platysma

Cleavage lines of Langer

- Imaginary lines determined by collagen & elastic fibres of skin

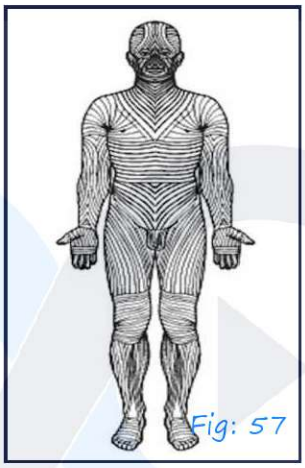


Fig: 57

- If the stab wound is

  i. Horizontal to cleavage lines → slit wound

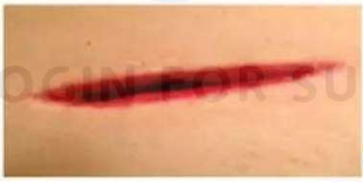


Fig: 58

  ii. Perpendicular to cleavage lines → gaping wound

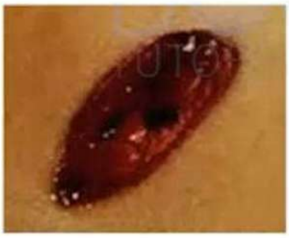


Fig: 59

Medico-legal importance of hilt contusion

- Indicates complete penetration
- Indicates the amount of force used
- Indicates the direction of force
- Helps in identification of the weapon
- Indicates the time since injury

Harakiri

- Method of suicide by stabbing into the abdomen & pulling out the intestine.
- Death due to sudden cardiac collapse
- In an axe, the upper end of the blade is known as toe end & the lower end is known as heel end.
  - Heel end usually strikes first (wound Is deeper)
  - Shape of the chop wound corresponds with the cross section of penetrating blade.

Fig: 60

- A sickle can cause both stab wounds and incised/chop wound.
- **Fabricated wounds** are mostly incised wounds.
  - They are forged wounds/self-inflicted wounds.

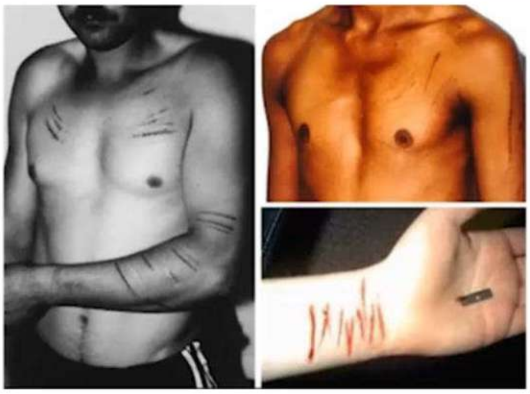


Fig: 61

Defence wounds

- There are the wounds sustained by a victim while trying to protect himself when attacked.
- They are usually not seen in the outer aspect of forearm.

BALLISTICS PART – I (BASICS)

Ballistics 00:00:21

- It is the study of firearms and its ammunition.
- Application of the knowledge of ballistics into the admiration of justice is known as forensic ballistics.

Ballistics are classified as

1. Internal/Interior/Proximal ballistics
    - Study of changes within gun
2. Extremal/Exterior/Intermediate
    - Study of trajectory of projectile.
3. Terminal wound
    - Study of effects on body.

Classification of firearms 00:02:56

- Smooth bored firearms (Short gun/Scattergun/Pepper gun)

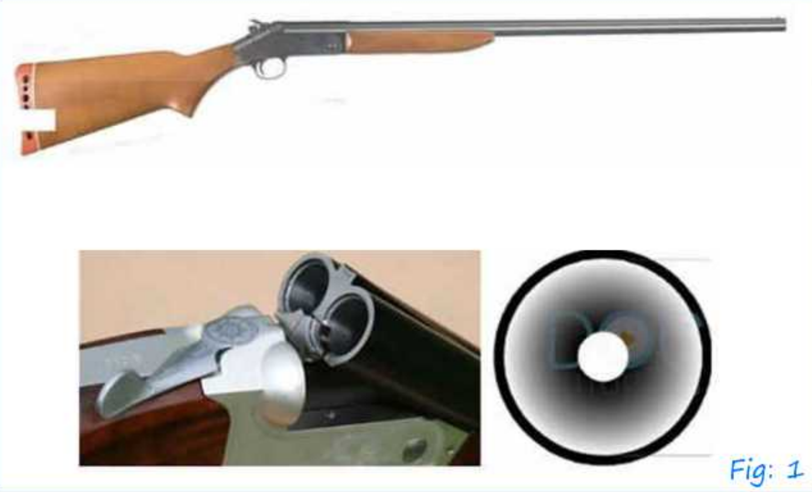


Fig: 1

  - Interior of barrel is smooth.
  - It can be single or double or triple or multiple barreled.

- Rifled firearms
  - Interior of the barrel is cut into spiral grooves → Provides spin to the bullet.

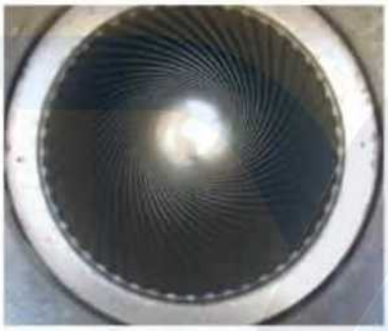


Fig: 2

- Paradox guns
  - It is a shotgun, but terminal 2-3'' of the barrel is rifled.
- Stud gun
  - It is an industrial tool.
- Air guns
  - Compressed air is used as propellent.
  - Gunpowder is not used as propellant.

Fig: 3

- Taser device

- It immobilizes attackers by using electric current.
- Can fire the electric probes at distance upto 15 ft.

Fig: 4

- Stun gun
  - High – voltage electricity to an attacker's body on direct contact.

Types of rifled firearms 00:11:14

1) Shoulder guns
   - The butt of the gun is placed on the shoulder.
     Example: Rifle and military rifle
   - They are long barreled guns.
2) Handguns
   - Example: Pistol, revolver
3) Carbines
   - Neither should gun nor hand gut
     Example: AK – 47, sten gun.
   - Empty cartridge cases are ejected out after firing in case of pistol or any other weapons with magazine
   - Instrument used to examine the interior of the barrel is helixometer

Effective range of firearms 00:18:01

- Short gun → 30-40m
- Musket → 90m
- Revolver → 150m
- Pistol → 200m
- Carbines → 300m
- Rifle → 1000-3000m
- The killing range of a military rifle is about 1000 yards.

Rifling 00:20:02

- Rifling means spiral grooves in the barrel → done by using lapped/Broach.

Fig: 5

- Lands → Elevated part
- Grooves → Depressed part
- Calibre/Gauze → Distance between 2 opposite land

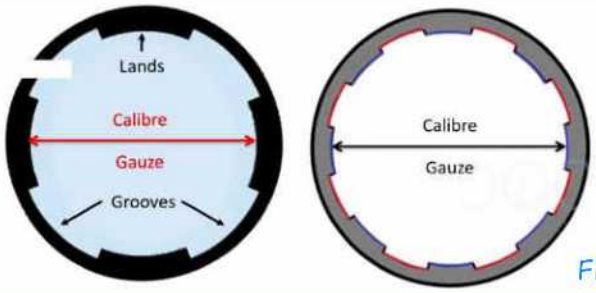


Fig: 6

- Rifiling imparts spin to the bullet → Gives gyroscopic stability

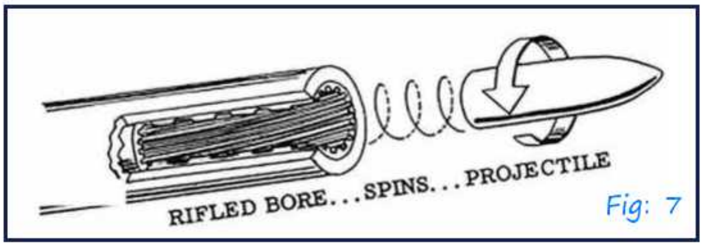


Fig: 7

Bullet markings 00:22:44

- Primary/class characteristics → d/t rifling (Impression of lands)
  → Macroscopic finding
  → Specific to the model

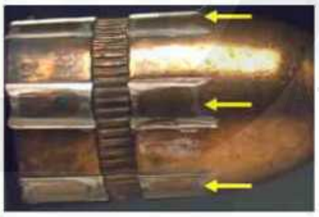


Fig: 8

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- Primary/Individual characteristic (Bullet fingerprinting)
  - Due to irregularities on surface of lands.
  - It is microscopic finding.
  - Specific to the individual gun.

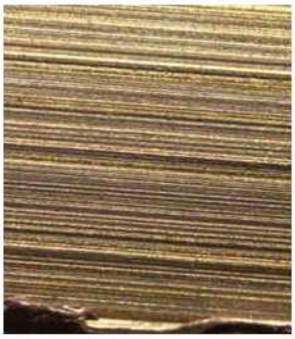

Fig: 9

Fig: 10

- Always collect the bullet with hand or rubber tipped forceps.

- Crime bullet (recovered from the body) and suspected gun (Recovered from the suspect) is sent to forensic science laboratory (FL) to a ballistic expert who has to give his opinion.
- Secondary characteristics are studied and compared under Comparison/mensuration microscope.
- If the secondary characteristics on the test bullet is compared with the secondary characteristics of crime bullet, the ballistic expert can give his opinion that the crime bullet has been fired from the suspected gun.

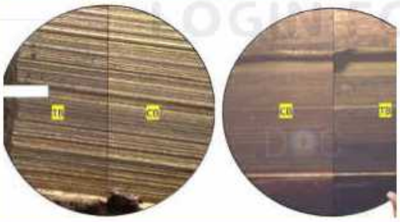

Fig: 11

Same principle is also used to study tool marks on base of cartridge.

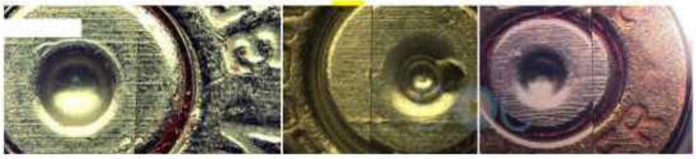

Fig: 12

Shotgun cartridge 00:37:44

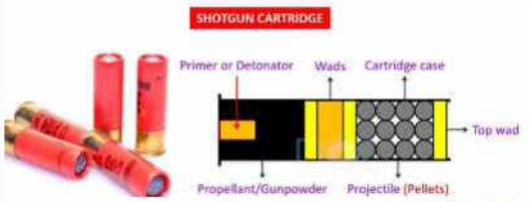
SHOTGUN CARTRIDGE
Primer or Detonator
Wads
Cartridge case
Top wad
Propellant/Gunpowder
Projectile (Pellets)

Fig: 13

Fig: 14

- Detonator cap is situated at the base of the rim. It is also known as brain of cartridge.

Primer / detonator 00:41:07

All are metal compounds; usually made up of a mixture of

- Barium nitrate
- Antimony sulphide and
- Lead styphnate

- Olden days → Potassium Chlorate was used

Propellant – gun powder 00:42:25

i. Black powder

- K^+ nitrate (75%)
- Sulphur (10%)

- Charcoal (15%)
- Fg, FFg, FFFg, FFFFG

Fg
FFg
FFFg
FFFFg

Fig: 15

- 1g of black powder liberates 3000-4500cc of gas

ii. Smokeless powder (SP)

- Single based → Nitro cellulose
- Double based → Nitro cellulose + nitroglycerine
- Triple based → Nitro cellulose + nitroglycerine + nitro guanidine
- 1 g of smokeless powder liberates 12000-13000cc of gas

iii. Semi smokeless

- 80% BP + 20% SP
- All propellants contain nitrous compounds

Gunshot residue (GSR) 00:48:14

- Burned out residue of propellant and primer is known as GSR
- GSR

  1. Primer (Mental compounds):

     i. Harrison and Gilroy test

     ii. NAA (Neutron activation analysis)

     iii. FAAS (Flameless atomic absorption spectroscopy)

iv. TMDT (Trace metal detection test)

v. SEM-EDX → Best

(Scanning electron microscope – Energy dispersing x-ray)

2. Propellant (Nitrous compound):

Can identify the nitrous compounds by

i. Dermal nitrate test

(Diphenylamine/paraffin test)

ii. Modified Griess test

- 5% HNO_3 or 10% HCL is used to swab GSR on hands.
- Sodium rhodizonate test is used to detect Pb around the wound of entry (Cloth or skin).
- GSR on skin and clothing can be best demonstrated by infrared photography.

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Wads 00:54:25

Fiber, Cork & Felt Wads
Dry
Lubricated

Fig: 16

- It separates projectiles from propellant.
- Helps to obturate the bore effectively.
- Prevents expanding gases from escaping.
- Allows optimum pressure to develop.
- Acts as piston.

- Prevents fusing/distorting the pellets from heated gun power.
- The air cushion wad which is impregnated with grease helps to lubricate the barrel.

Power piston

- It may be used instead of wads; has got 3 or 4 flaps.

Fig: 17

- M.L.I.
  - Once the gun is fired, the flaps:
  - Start opening at 30cm
  - Completely opens at 60cm
  - Folds back at 90cm

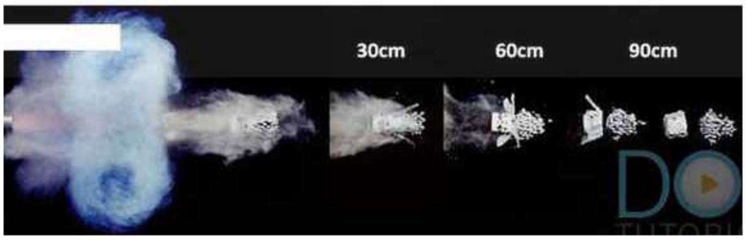

Fig: 18

- If the target is hit, when the flaps are opened, it gives rise to cross pattern abrasion (Maltese cross) around the wound of entry

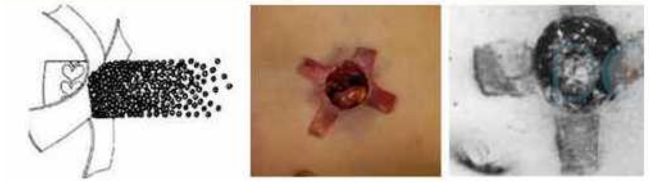

Fig: 19

Projectile in shot gun 00:59:39

- Projectiles are known as pellets.
- Pellets are usually made of Pb.
- It is hardened by adding antimony (Chilled shot).
- Depending on the size of the pellets, it can be
  - Dust shot

    (<1.75mm)

Fig: 20

  - Bird shot

    (1.75 to 6mm)

Fig: 21

  - Buck shot
    (>6mm)

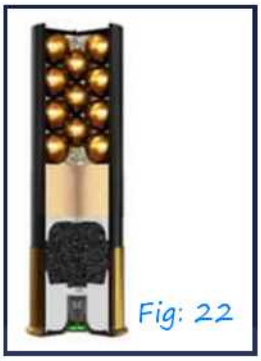

Fig: 22

- Slug (single shot)

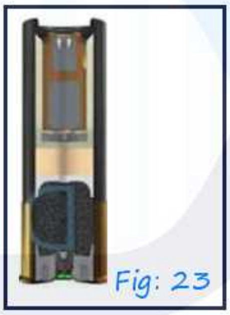

Fig: 23

  - In a musket (A shotgun, used by Indian police), a single lead ball or slug is used.

Bore of a shotgun 01:02:18

- Usually mentioned in number, that is 12 bore, 16 bore, 20 bore etc.
  - Number of lead balls of equal size and shape prepared from 1 pound of lead, so that each ball precisely fits the interior of the barrel.

Example: 12 bore shotgun means, 12 balls of equal size and shape are prepared from 1 pound of lead, each ball precisely fitting the interior of the barrel.

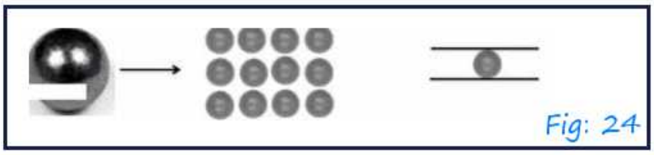

Fig: 24

- Greater the bore, lesser the lumen of the barrel.

Choking of a shotgun 01:04:47

- Narrowing of the distal part (7-10cm) of barrel to reduce dispersion of pellets.

Fig: 25

- In no choke → maximum dispersion
  In full choke → minimum dispersion

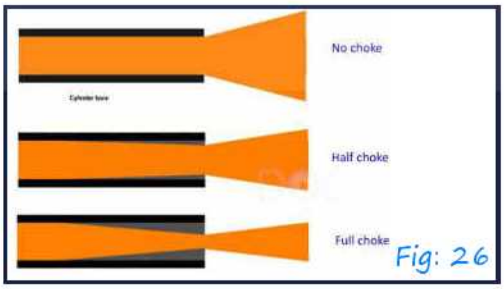

Fig: 26

Billiard ball phenomenon 01:07:58

- When a shot gun is fired through an intervening object such as glass, at the time of impact with the glass, the pellets in the front get hit by those pellets in the behind so that there will be erroneous dispersion of the pellets.

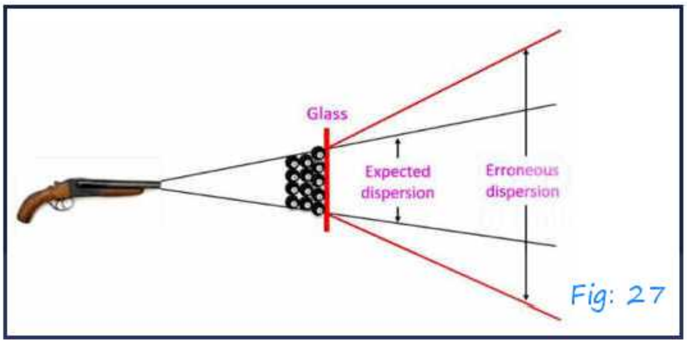
Glass
Expected dispersion
Erroneous dispersion

Fig: 27

Balling or welding of the shot

- Conversion of shots into a compact mass usually by adding paraffin wax or glue.
- Rarely happens in old ammunition.

Rifled firearm cartridge

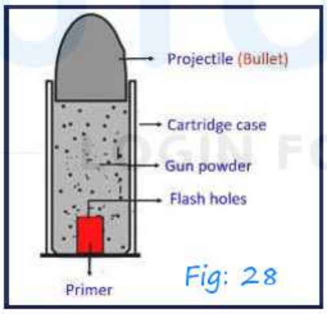
Projectile (Bullet)
Cartridge case
Gun powder
Flash holes
Primer

Fig: 28

Tandem cartridge/Duplex cartridge

- 2 bullets are placed in a single cartridge

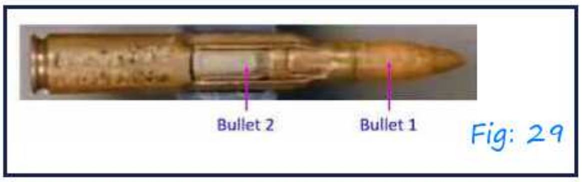
Bullet 2
Bullet 1

Fig: 29

Tandem bullet/Piggyback bullet

- Bullet stuck in the barrel is ejected out with subsequent shot

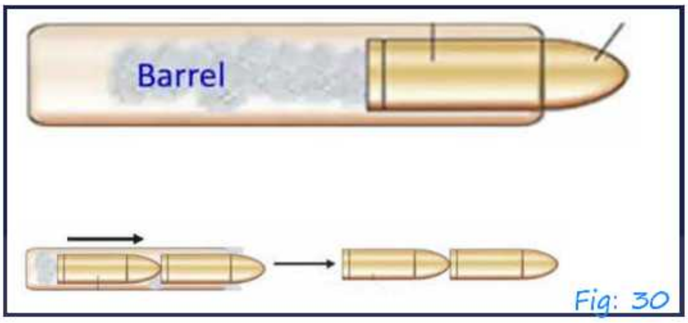

Fig: 30

Bullets 01:16:23

- $KE = \frac{1}{2} MV^2$
- Destructive power of bullet is determined by
  - Velocity of bullet
  - Weight of bullet
  - Size of bullet
- Destructive power of the bullet mainly determined by velocity of bullet.
- Bullets are usually made up of lead, due to its higher sectional density.
- Disadvantage of lead → Erosion and deformation
- There are 3 types of bullets
  - Fully jacketed

Fig: 31

- Semi-jacketed

Fig: 32

- Un-jacketed

Fig: 33

- Semi-jacketed and un-jacketed bullets

↓

Scattered bullet fragments (with/without hitting bone)

↓

Lead snowstorm phenomenon (X-ray)

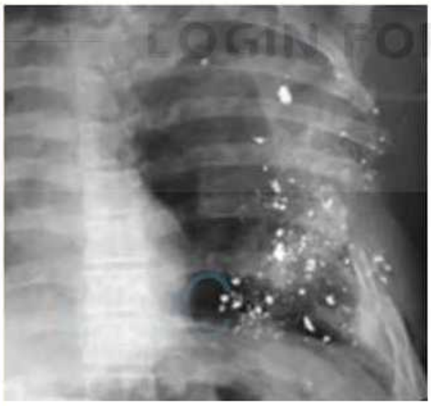

Fig: 34

Lead snowstorm phenomenon may be seen whenever Pb is exposed, such as Dumdum bullet, express bullet and fragmentary bullet.

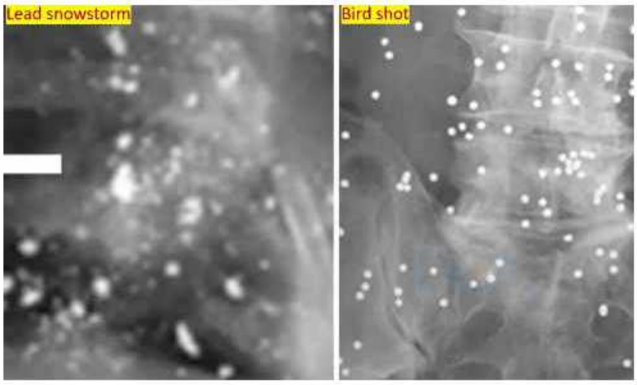
Lead snowstorm
Bird shot

Fig: 35

Expandable bullet 01:22:11

- Two types are there
  1) Dum dum bullet → Jacketed bullet with nose cut off

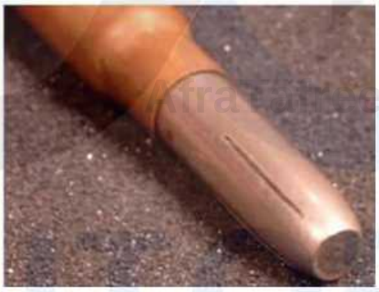

Fig: 36

  2) Hollow point/Express bullet → Jacketed bullet with a hole tip

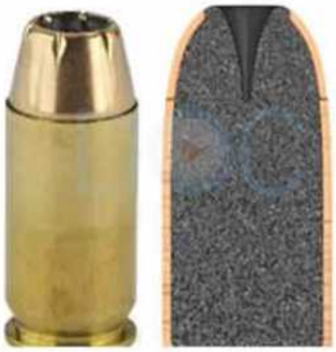

Fig: 37

- Lead is exposed in both the cases and mushroom out on hitting the target.

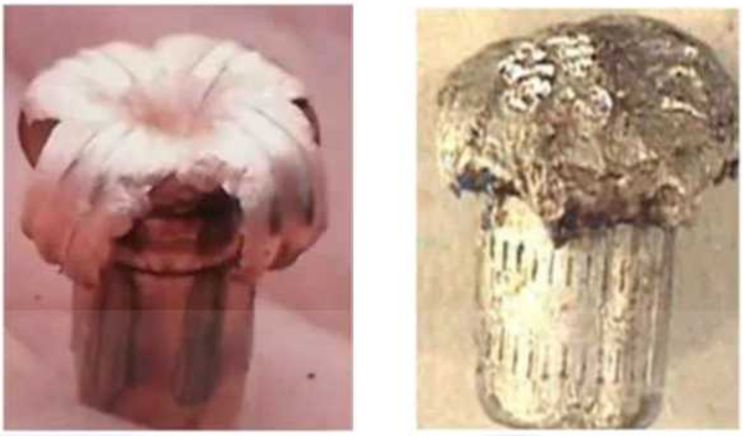

Fig: 38

- It causes greater damage to the tissue.

Explosive bullet/Magic bullet 01:24:26

- Bullet tip is drilled out and a Pb azide (primer) canister is inserted

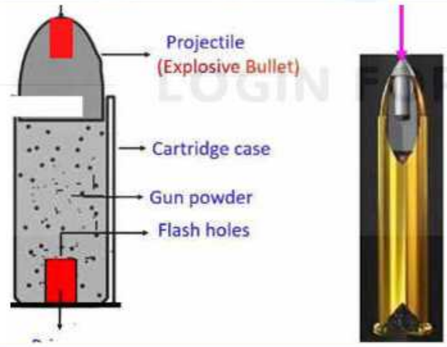
Projectile
(Explosive Bullet)
Cartridge case
Gun powder
Flash holes

Fig: 39

- Bullet explodes on hitting
- Explosive bullet has detonator cap on distal aspect.

FIRE ARM PART – II (WOUND BALLISTICS)

Rifled Firearm Wound Ballistics 00:00:31

Products of Firing and its effects

i. Flame & hot air → scorching/burning + singeing

ii. Soot/smoke → Blackening or smudging

iii. Powder particles → Tattooing/peppering or powder stippling

iv. Bullet → Wound of entry + Grease & abrasion collar

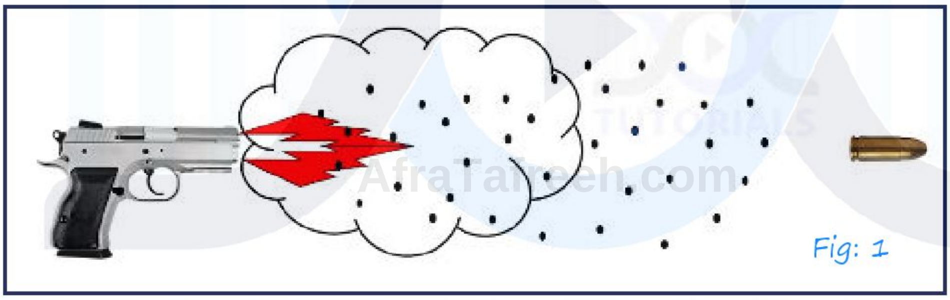

Fig: 1

Distance travelled by products of firing (Average) 00:04:23

Product	Rifled firearm	Shotgun
Flame	8 cm	15 cm
Smoke	15 cm	30 cm
Powder particles	40-50cm (Handguns) 60-100 cm (Rifles)	60-90 cm

Wads	Not applicable	2-5 metres (within the wound up to 2 metres)

Different Ranges of Rifled Firearm 00:07:11

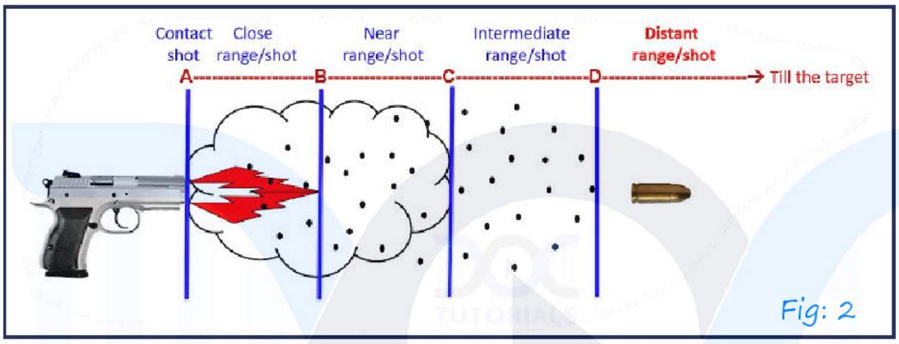
Contact shot
Close range/shot
Near range/shot
Intermediate range/shot
Distant range/shot
A
B
C
D
Till the target

Fig: 2

I. Distant range/shot

- Target is beyond the reach of powder particles, soot & smoke and flame.
- Grease is applied inside the barrel to lubricate. The lubricating material, the foreign bodies and fibres get transferred in to the surface of the bullet.

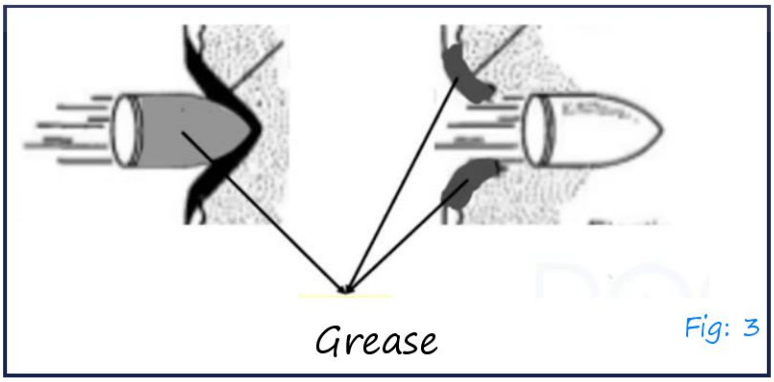

Fig: 3

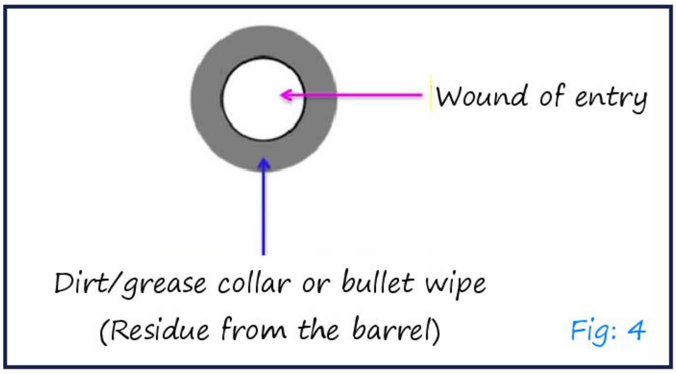
Wound of entry
Dirt/grease collar or bullet wipe
(Residue from the barrel)

Fig: 4

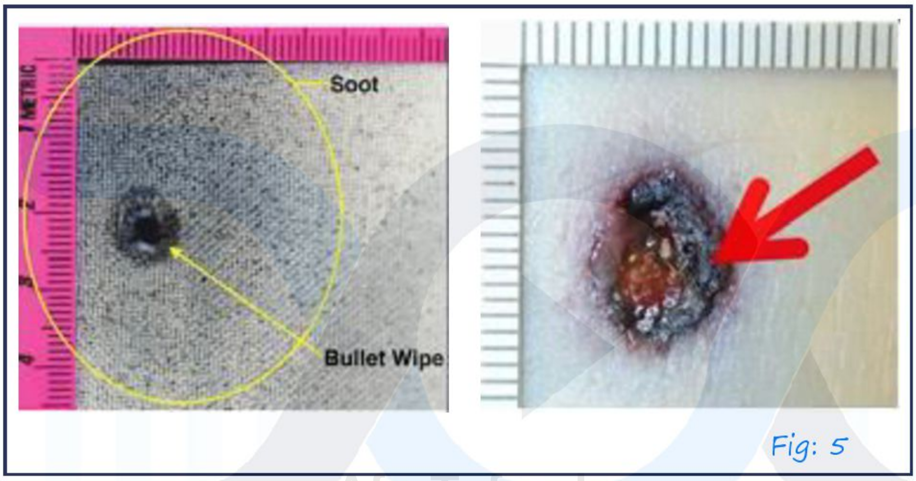
Soot
Bullet Wipe

Fig: 5

- Fouling
  - Bullet scrapings around the wound of entry, seen within grease collar
- Grease collar is seen with firearm entry wounds.
- Bullet wipe is derived from the residue from the barrel of the gun.

Abrasion/Contusion collar 00:15:46

- At the time of penetration of the bullet through the skin, there will be indentation of the skin.
- The spinning bullet causes friction with the indented (invaginated) skin, which leads to the formation of an abrasion around the wound entry

- Sometimes it is associated with contusion just next to the abrasion collar, known as contusion collar/ring
- Rarely there will be only contusion collar

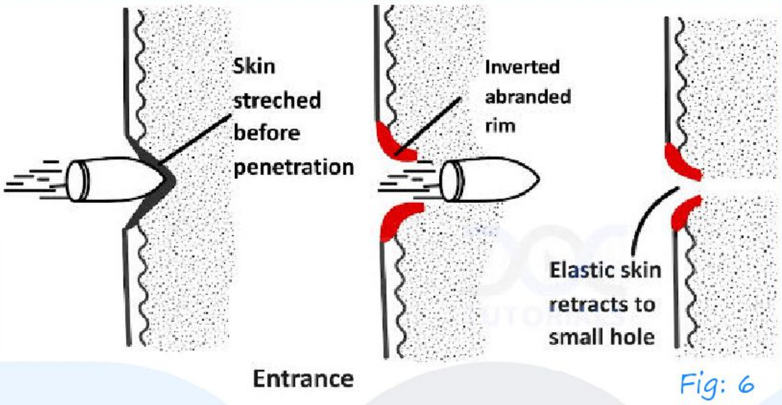
Skin
streched
before
penetration
Inverted
abranded
rim
Elastic skin
retracts to
small hole
Entrance

Fig: 6

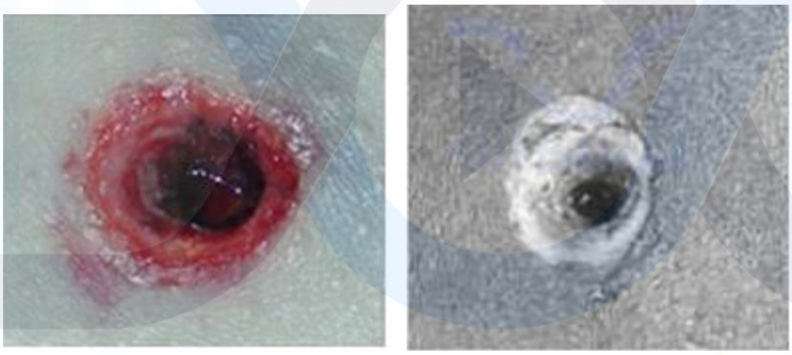

Fig: 7

Wound of entry & abrasion collar 00:18:15

i. Perpendicular entry → Circular

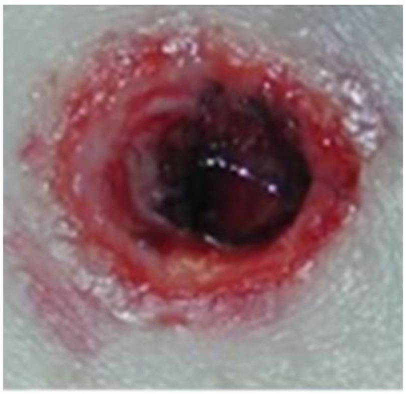

Fig: 8

ii. Tangential entry → Egg shaped (ovoid)

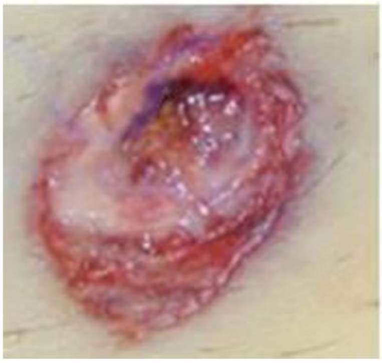

Fig: 9

- Abrasion collar helps to know direction of the bullet.

II. Intermediate range/shot

- Only tattooing around the wound is seen in intermediate shot.

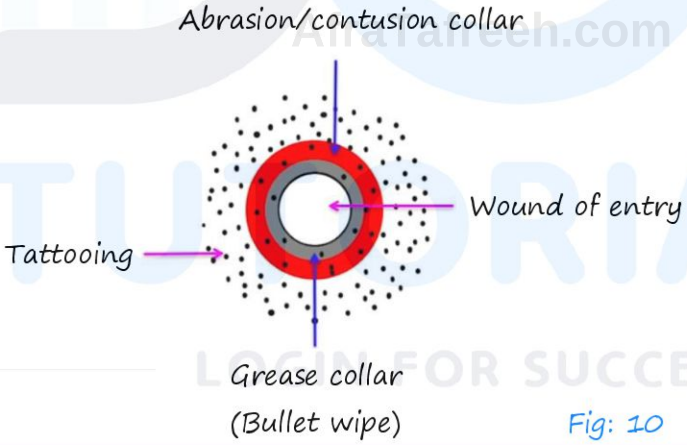
Abrasion/contusion collar
Wound of entry
Tattooing
Grease collar
(Bullet wipe)

Fig: 10

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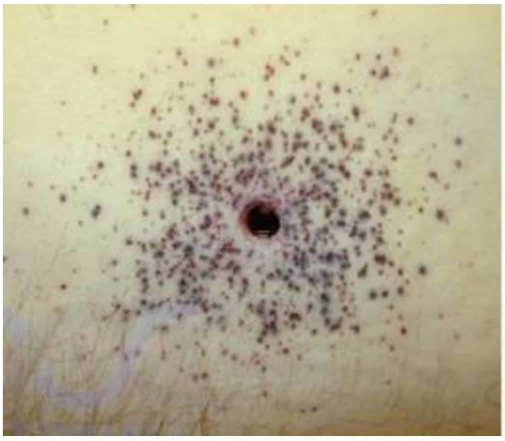


Fig: 11

III. Near range/shot

- Only tattooing and blackening around the wound is seen in near shot.

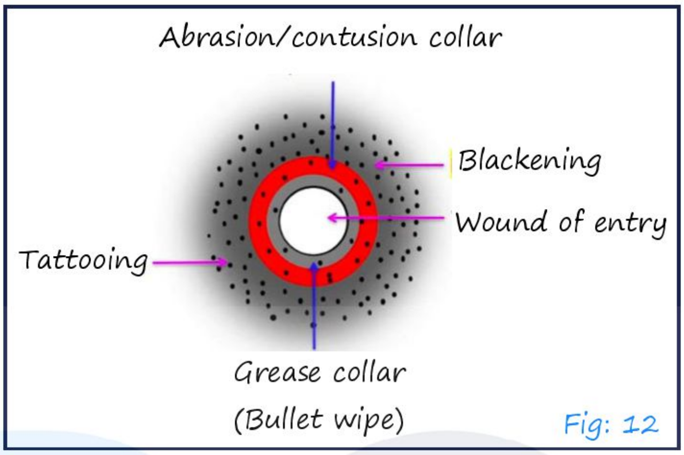

Abrasion/contusion collar
Blackening
Wound of entry
Tattooing
Grease collar
(Bullet wipe)

Fig: 12

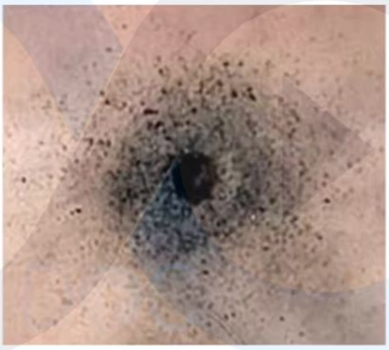


Fig: 13

IV. Close range/shot

- Singeing of hair is seen in close shot.
- Tattooing around the wound of entry is seen in close shot.

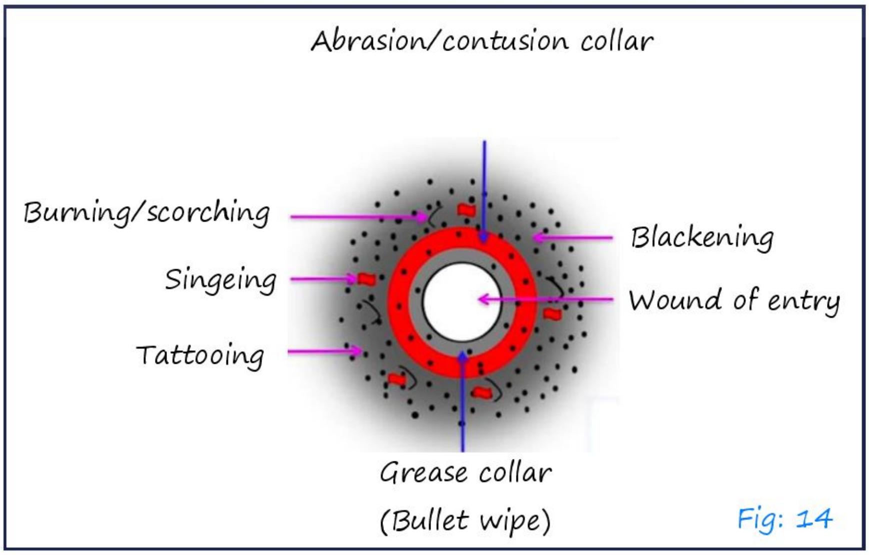

Abrasion/contusion collar
Burning/scorching
Singeing
Tattooing
Blackening
Wound of entry
Grease collar
(Bullet wipe)

Fig: 14

V.Contact shot

- Here the muzzle is in contact with the skin

1.Hard/Firm/Tight contact

- Indentation of skin
- Absolutely no gap between skin and muzzle.
- All the products of firing enter the wound tract.
- Muzzle impression

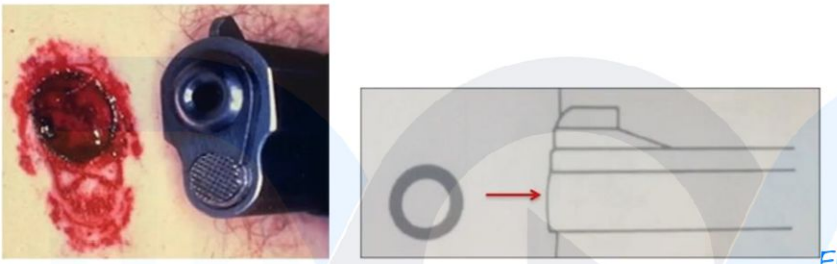


Fig: 15

2.Loose contact

- No indentation of skin.
- Gap between skin & muzzle due to invagination of skin.
- Shoot escape & deposit around the wound.

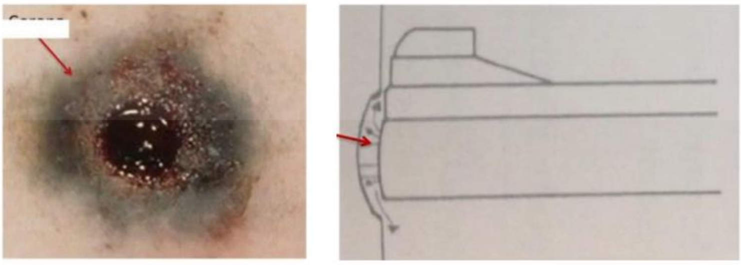


Fig: 16

- Corona (Blackening)
- Burning
- Singeing
- Muzzle impression (unlikely)

3.Angled contact

- Gap between the skin & muzzle due to angular position
- Escape of powder particles, soot and flame through the gap.

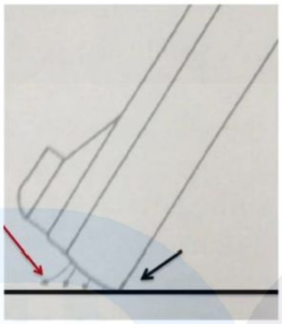


Fig: 17

- Partial muzzle impression
- Blackening (ovoid)
- Tattooing
- Burning
- Singeing
- Muzzle impression (unlikely)

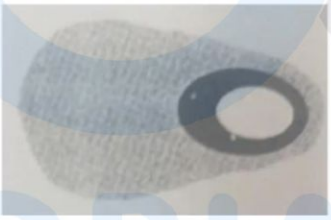


Fig: 18

Contact shot on bony areas (Head, sternum)

- There is escape of gas between skin and bone that forms a temporary bulge.

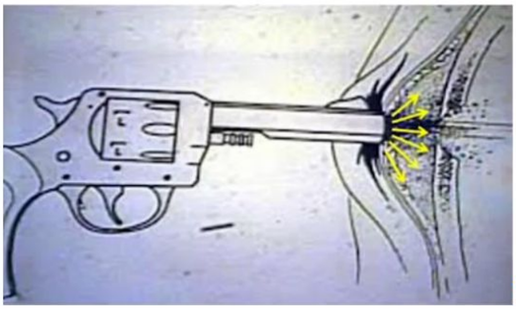
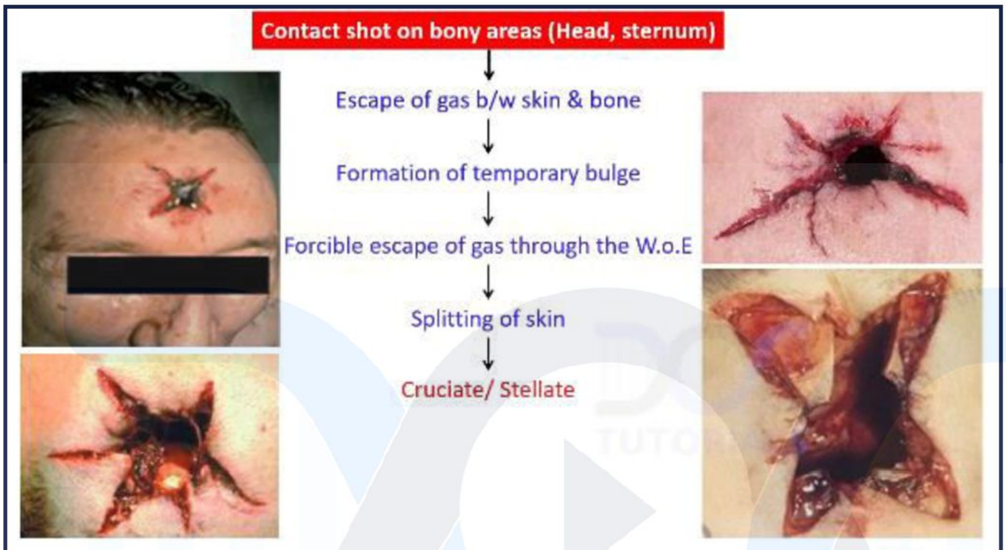


Fig: 19

- Then there is a forcible escape of gas through the wound of entry thereby splitting the skin and giving rise to cruciate/stellate shaped wound that is large and irregular.



Contact shot on bony areas (Head, sternum)

↓

Escape of gas b/w skin & bone

↓

Formation of temporary bulge

↓

Forcible escape of gas through the W.o.E

↓

Splitting of skin

↓

Cruciate/ Stellate

Fig: 20

Cherry red discolouration 00:30:32

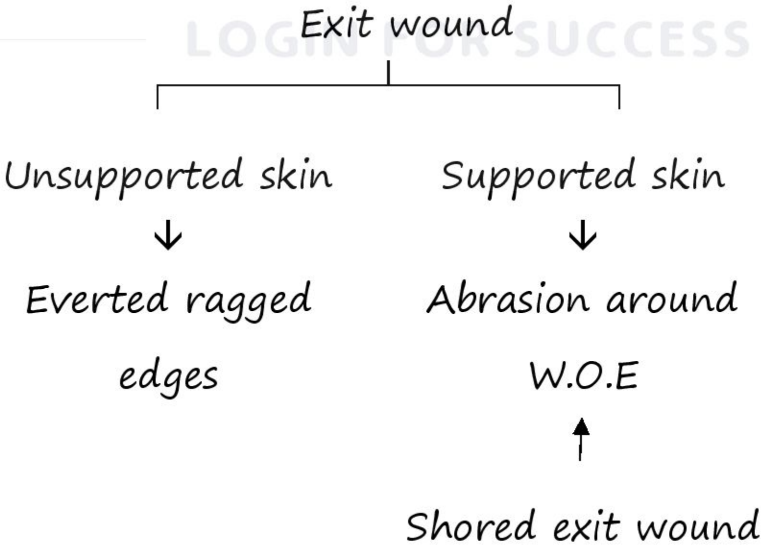
- CO (Smoke) + Hb = COHb
- Seen in contact, close and near shot
- Point blank – shooting is done from the gun that is fired from extremely close to the target or when almost touching it.
- In revolver
  - Peppering present → <50cm
  - Soot present → < 15cm
  - No singing & burning → >8cm

Distance travelled by products of firing (Average)

Product	Rifled firearm	Shotgun
Flame	8cm	15cm
Smoke	15cm	30cm
Powder particles	40-50cm (Handguns) 60-100cm (Refiles)	60-90 cm
Wads	Not applicable	2-5meters (Within the wound up to 2meters)

Exit wound 00:38:22

- Unsupported skin
  - Everted & ragged edges


Exit wound
Unsupported skin
Supported skin
Everted ragged edges
Abrasion around W.O.E
Shored exit wound

- Supported skin
  - Abrasion around wound of exit is seen & is known as shored exit wound.

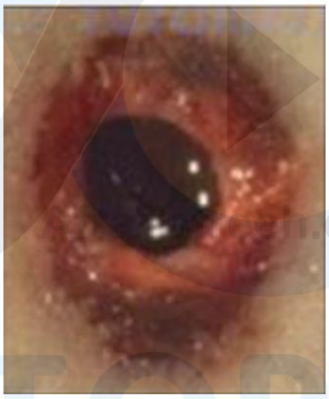


Fig: 21

- Reliable sign of rifled firearm wound of entry is grease collar.
- Feature of gunshot injury are gutter injury grease collar, radiating wound, tissue opening on opposite end.

Back spatter 00:42:13

- It is sucking of blood hair, fragments of tissue & cloth fibers, back in to the barrel due to negative pressure.
- Seen in contact shot (MC) & close ranges.

- Most common with shotguns.
- Helps in identification of weapon
- Forward spatter
  - Splashing of blood & tissue fragments through wound of exit

Bullet 00:44:06

1. Low velocity bullet (<340m/s)
   - It forms a permanent cavity due to crushing.
2. High velocity bullet (>850m/s)
   - It forms permanent + Temporary cavity + Tissue quake

- Low velocity bullets as in hand guns, that travel less than 100fps do virtually all their damage via crushing.

Kronlein shot 00:47:05

- It may be seen in contact shots & high velocity refiled weapons.
- Here the skull is shattered & evisceration of the brain.

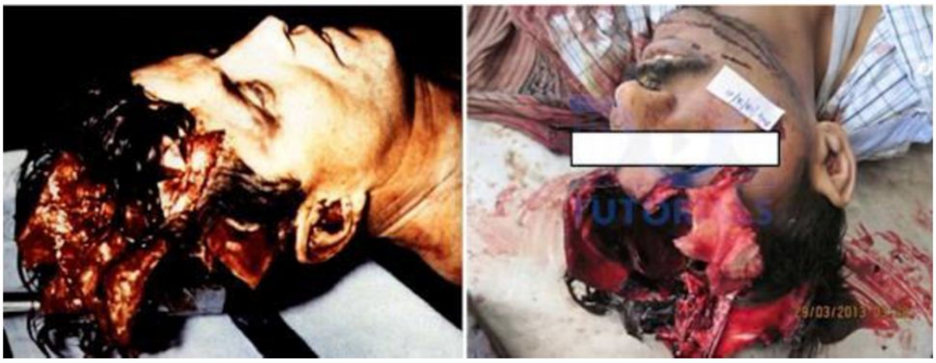


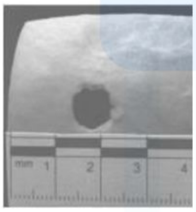
Fig: 22

Bullet shot into skull 00:49:40

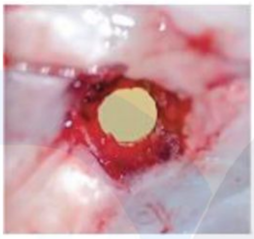
Bullet shot into skull

Wound of entry

- Outer table ↓ Clean cut ↓

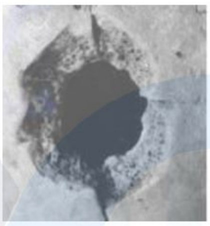


- Inner table ↓ Bevelling/Crater ↓



Wound of exit

- Inner table ↓ Clean cut
- Outer table ↓ Bevelling/Crater ↓



Key hole (Longitudinal) wound of entry bullet

00:52:40

1. Ricochet bullet
   - Bullet is deflected by an object rather than penetrating & becoming embedded in that object.
   - Internal ricochet may occur when the bullet strike hard tissue
2. Tumbling/somersaulting bullet
   - Bullet rotates on its longitudinal axis.
3. Yawning/wobbling bullet
   - Bullet moves in irregular fashion.

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TUTORIALS
LOGIN FOR SUCCESS

Keyhole defect 00:58:00

- May be seen in skull when the skull is hit by a bullet at an angle.

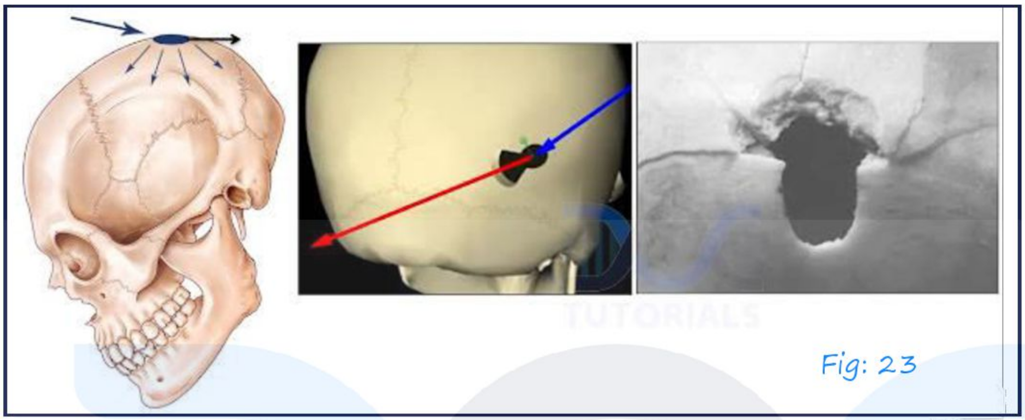


Fig: 23

- Keyhole defect is a feature of angled bullet.

Puppe's rule 00:59:11

- A Fracture line will not cross an already existing fracture line.
- Helps to determine the sequence of short fired

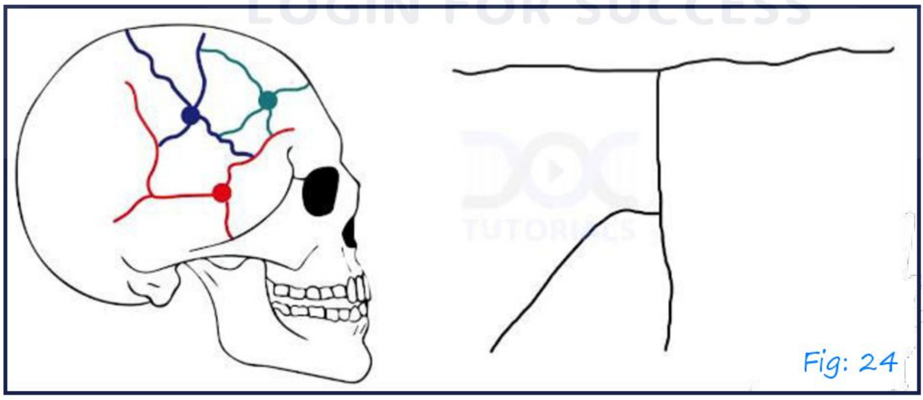


Fig: 24

Kennedy's phenomenon 01:01:25

- Surgical intervention of gunshot wounds (Proper evaluation of wounds become difficult)

Souvenir bullet 01:02:51

- Bullet retained in the body for long time.

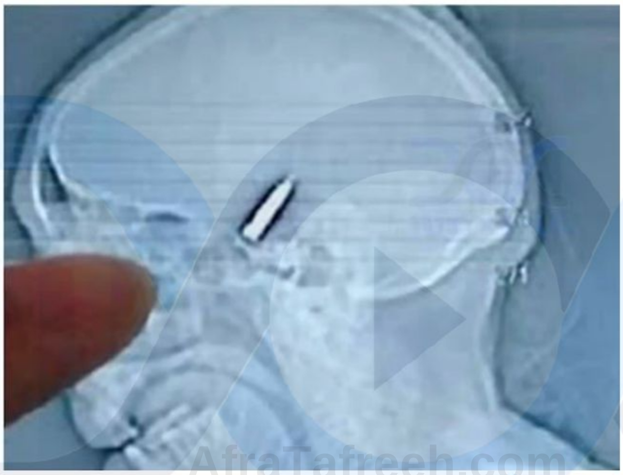


Fig: 25

Rayalaseema phenomenon 01:03:44

- The bullet is stuffed into stab wound of the victim to mislead the police.

Shot gun wounds of entry 01:04:36

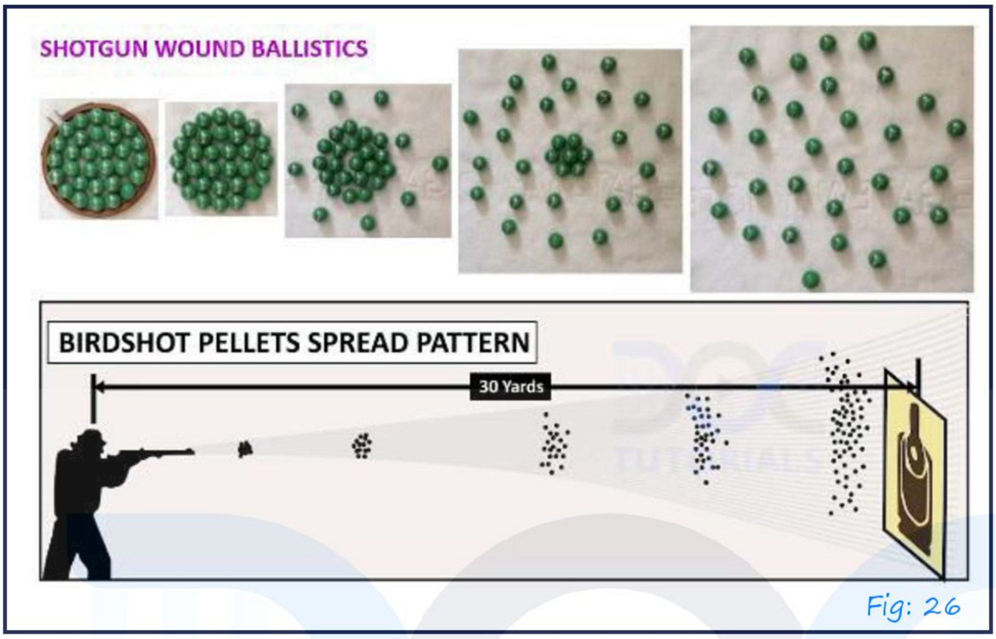

SHOTGUN WOUND BALLISTICS
BIRDSHOT PELLETS SPREAD PATTERN
30 Yards

Fig: 26

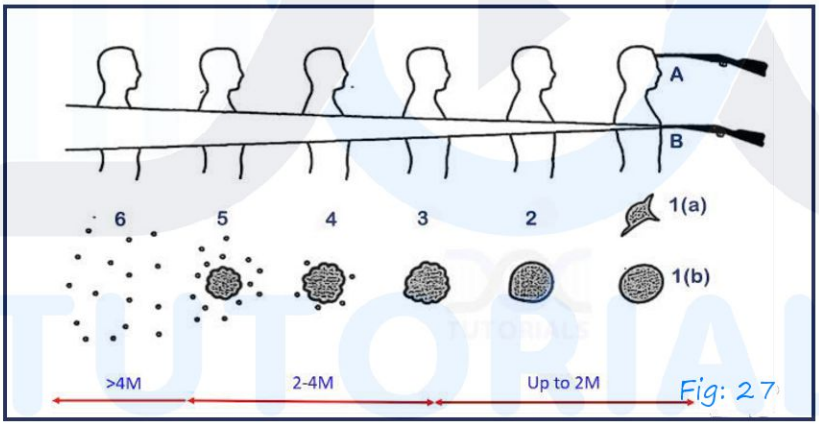

A
B
6
5
4
3
2
1(a)
1(b)
>4M
2-4M
Up to 2M

Fig: 27

- Close shot
  - Close range (Up to 1cm)
  - Short range (1-2m)
  - Here there is no dispersion
  - Single wound of entry
  - Rate hole wound of entry is seen (cookie cutter, scalloping, Nibbling, crenation)

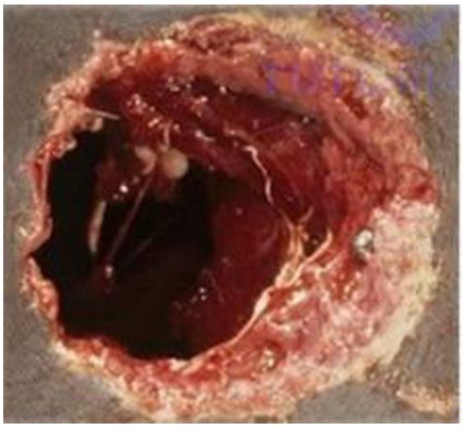


Fig: 28

- 2-4m (Intermediate range)
  - There is partial dispersion
  - Main wound of entry

    +
  - Satellite wounds are seen

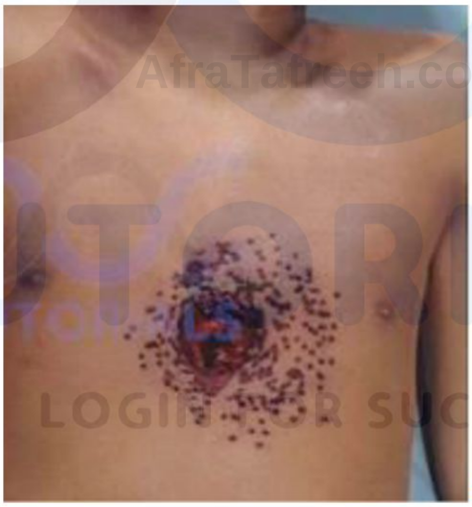


Fig: 29

- >4m (Distant range)
  - There is complete dispersion.
  - There are multiple wounds of entry.
  - Exit wounds are generally not seen in short guns, & if seen it's only seen in contact shots.

Estimation of range of short gun in yards by spread of pellets in inches

- In a half choke gun
  - Spread in inches = Range in yards
- In half choke gun
  - Spread in inches = ¾ of range in yards (range in yards = 4/3 X spread in inches)
- For no choke gun
  - Spread in inches = 1.5 x range in yards (Range = 2/3 x spread in inches
- The spread of pellets from a full choke short gun
  - 5m = 8cm
  - 10m = 25cm
  - 15m = 35cm
  - 20m = 45cm
  - 30m = 75cm

BOMB BLAST INJURIES

Bomb blast 00:00:12

i. **Primary blast injuries**

- It is due to the shock wave (blast wave).
- Force of explosion is concentrical.

Common organs involved in blast injuries

- Air blast
  - Ear drum
  - Lung
- Immersion blast
  - If head is out → GIT
  - Complete immersion → Ear drum
- Solid blast
  - Bones

ii. **Secondary blast injuries**

- It is due to flying missiles

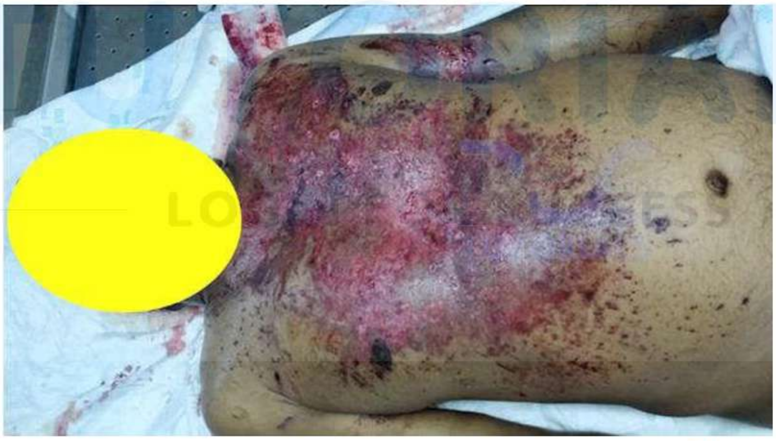


Fig: 1

- Marshal's triad (Body stippling)
  - Abrasion
  - Contusion
  - Laceration

iii. Tertiary blast injuries

- It is due to blast wind
- Injuries due to impact with another object.

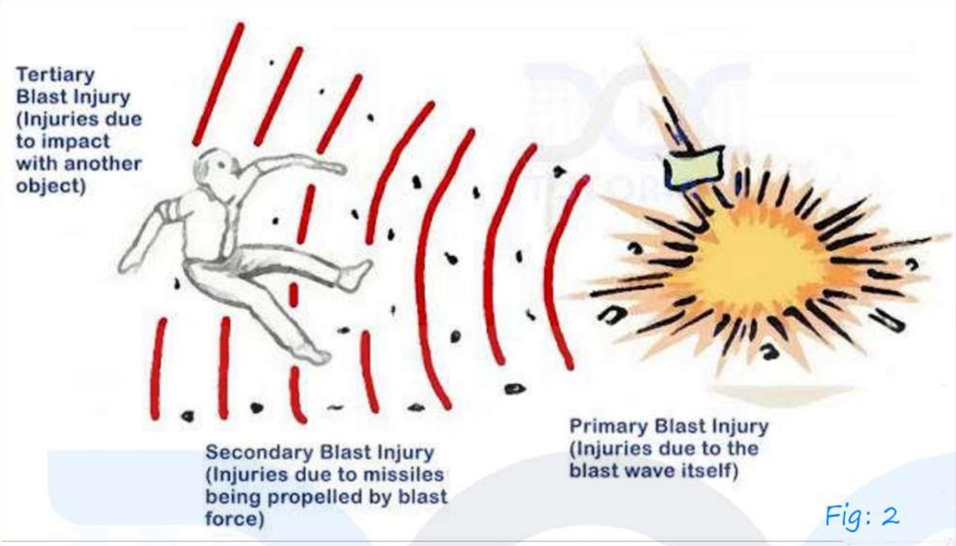

Tertiary Blast Injury (Injuries due to impact with another object)
Secondary Blast Injury (Injuries due to missiles being propelled by blast force)
Primary Blast Injury (Injuries due to the blast wave itself)

Fig: 2

iv. Quaternary blast injuries

- They are complications due to burns & toxic fire gases.

v. Quinary blast injuries

- Illness, injuries or disease caused by chemical, biological or radiological substances.

Molotov cocktail is an incendiary bomb.

Fig: 3

REGIONAL INJURIES

Head injury 00:00:17

- Any trauma leading to injury of scalp/skull /brain is known as head injury.
- Closed head injury –Dura is intact
- Open head injury –Dura is not intact
- Skull is pierced by 73N. The minimum force required to fracture a skull is 73 Newton.

Fractures of vault of the skull 00:01:34

1.Fissured /linear fracture

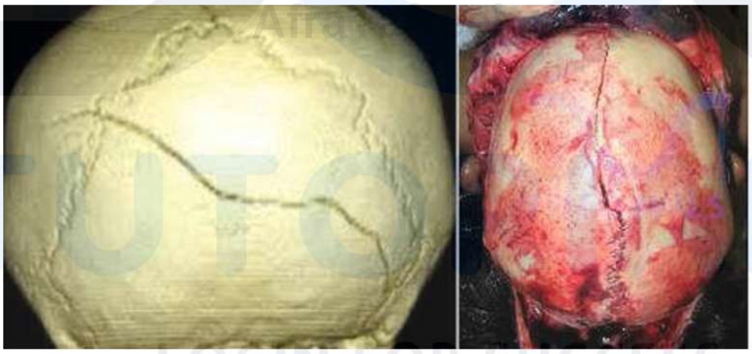


Fig: 1

- This involves the whole thickness or only inner /outer table.
- Most common fracture (about 70% of skull fractures)
- Crack fracture -> fracture of only one table, either outer or inner

2. Radiating fracture

- Many fracture lines radiating from a single point.

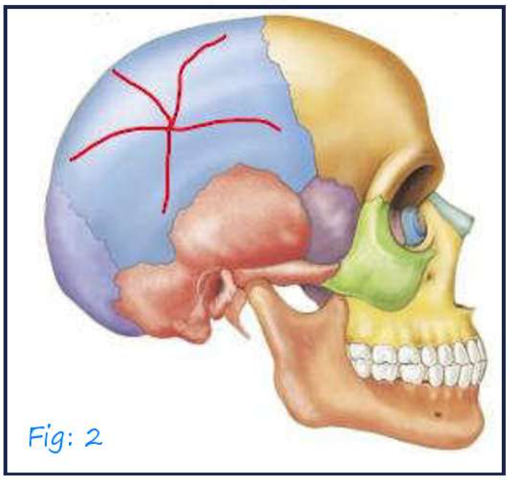


Fig: 2

3.Depressed fracture (signature fracture/fracture a la signature)

- Caused by blows from heavy weapon with a small striking surface.

  Example: stone, stick, hammer, etc

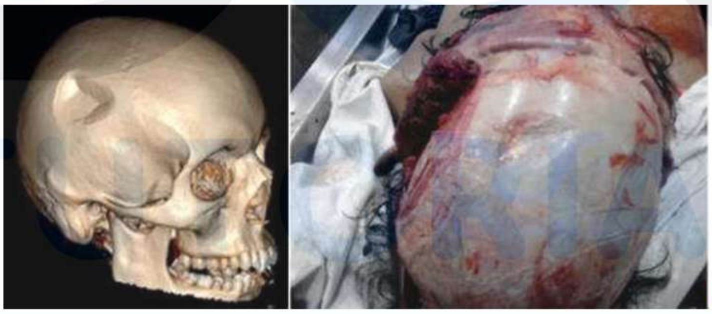


Fig: 3

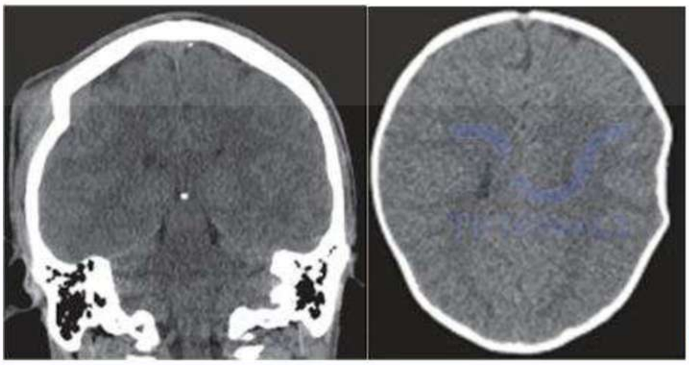


Fig: 4

4.Elevated fracture

- One end of fractured fragment is elevated over the surface of the skull and the other end may be depressed into cranial cavity.

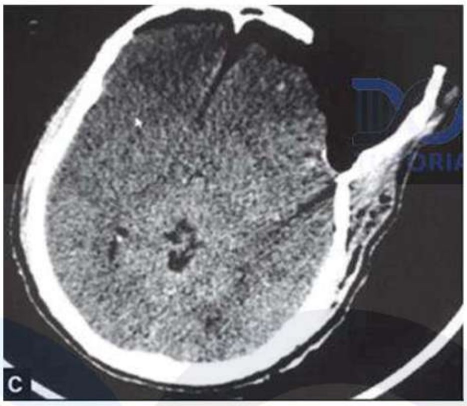


Fig: 5

5. Comminuted fracture (spider web/mosaic fracture)

- Bone gets broken into multiple pieces.
- Usually occur as a complication of fissured or depressed fracture

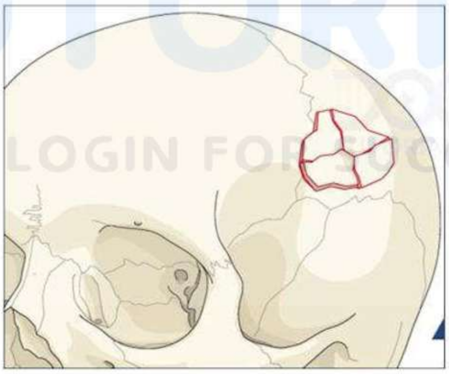


Fig: 6

6.Pond fracture/Indented fracture/Ping-pong ball fracture

- May be seen in new born or infants (skull is elastic).

- Usually produced by forcible compression of the skull by obstetric forceps or impact against some protruding flat object.

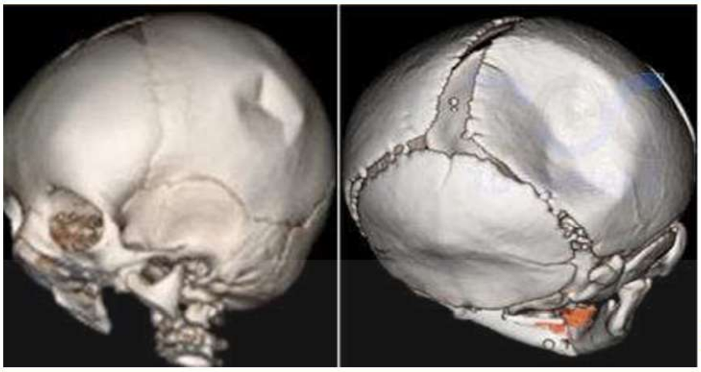


Fig: 7

7.GUTTER fracture

- There is a furrow in the outer table.
- Frequently accompanied with comminuted depressed fractures of the inner table. example: glancing bullet injury

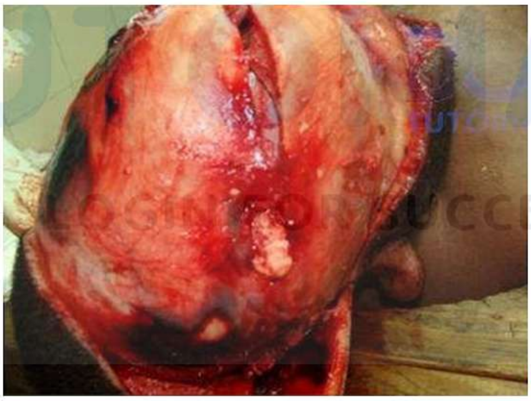


Fig: 8

- Gutter fracture is due to fire arm injury.

8.Separation of suture (Diastatic fracture)

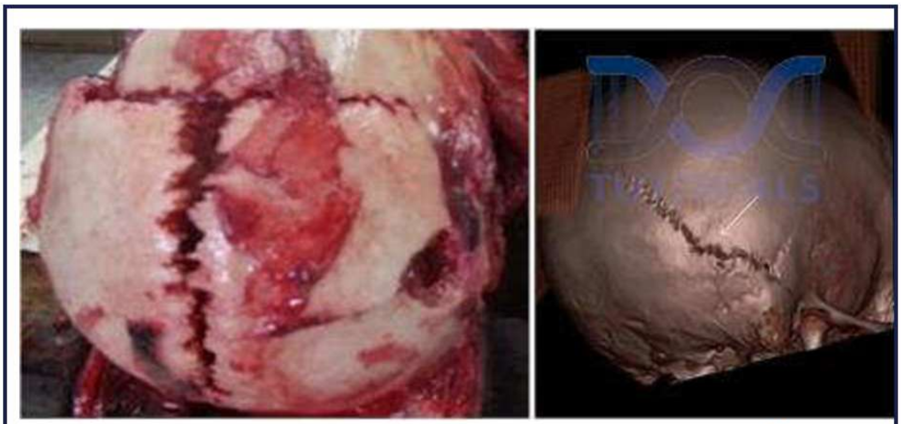


Fig: 9

- Here, fracture line involves separation of one or more cranial sutures.
- Sagittal suture is commonly involved.
- Most often seen in children and in young persons before the closure of the sutures.
- Commonly associated with EDH.

9.Expressed fracture

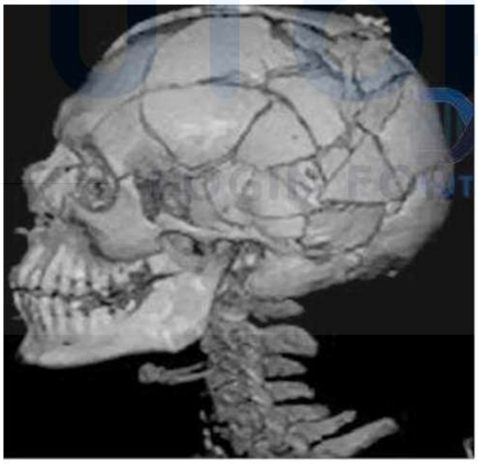


Fig: 10

- Massive fragmentation /shattering of skull.
- Due to massive trauma/fire arm contacts shots /blasts etc.

10. Penetrating fracture
    - Objects penetrating the cranial cavity.

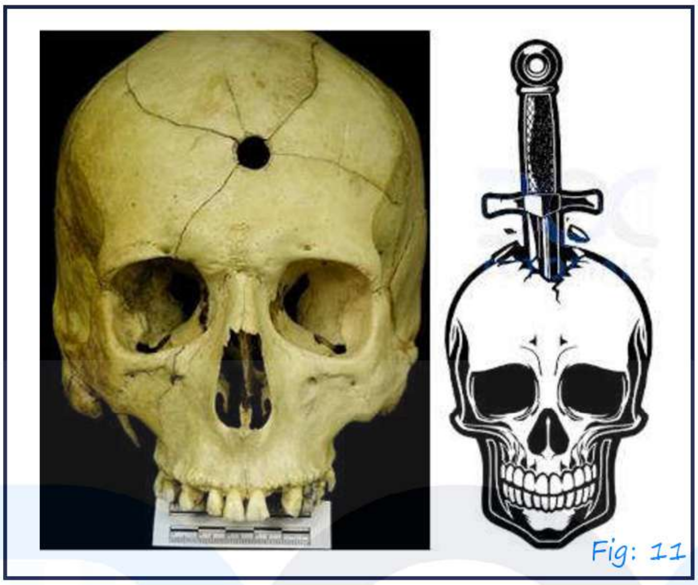


Fig: 11

11. Perforating fracture
    - There is wound of entry and wound of exit.

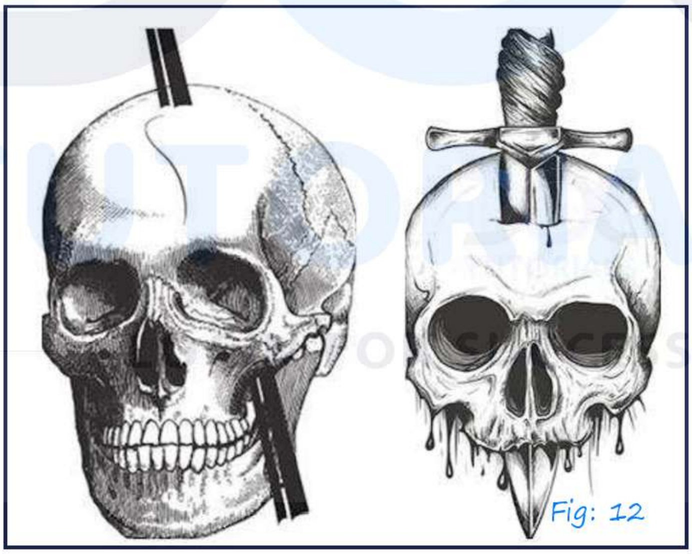


Fig: 12

12. Counter-coup fractures:
    - Most common in orbital roof.
    - Fracture on the opposite side of the area of impact
    - It is due to development of negative pressure.

- The involvement of frontal region may be explained because of development of 'negative pressure 'within this region resulting from differential movements of brain versus skull following occipital impact that leads to implosion of the relatively thin and weak orbital roof.

13. Growing skull fracture (GSF)
    - 90% of GSF are seen under 3 years.
    - It is never found after the age of 8 years.
    - Most commonly seen in parietal bone.

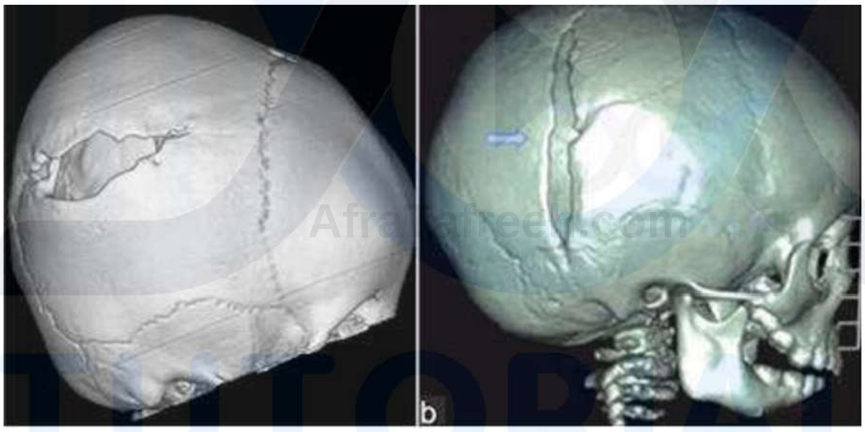


Fig: 13

14. Blow Out fracture

- It is the fracture of orbital wall, usually the interior walls but the orbital rim is intact.
- Caused by an impact by an object larger than orbital aperture.

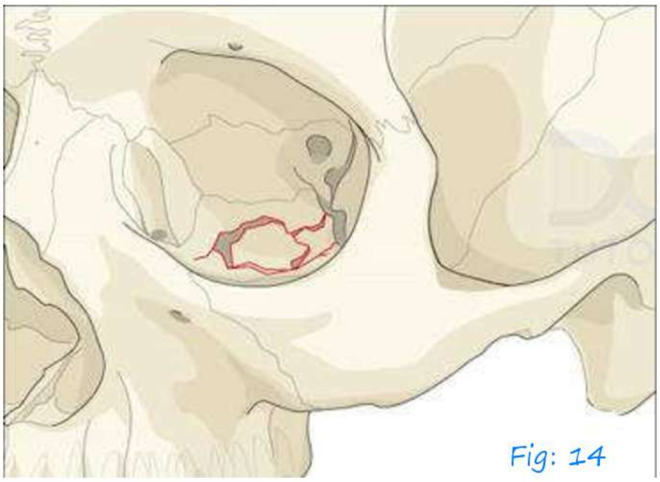


Fig: 14

- The periorbital pad of fat may protrude through the fracture line and on radiological examination may give rise to 'tear drop' sign.

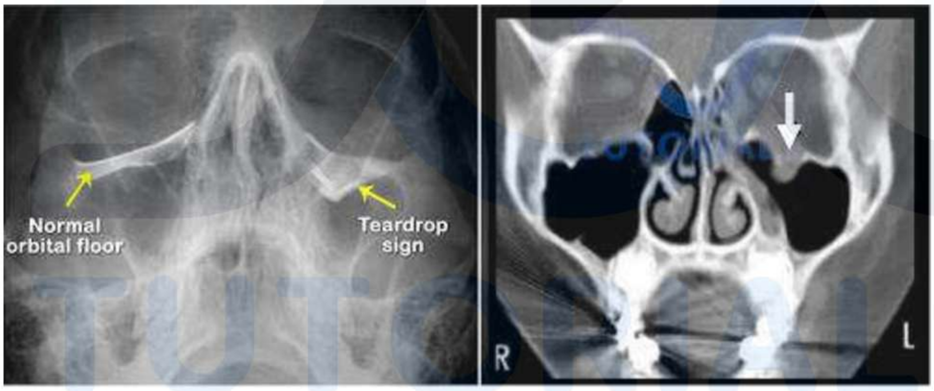

Normal
orbital floor
Teardrop
sign
R
L

Fig: 15

Polar (bursting) fracture

- The fracture caused not at the point of impact, but some distance away from it.
- Polar fracture is always a fissured fracture.

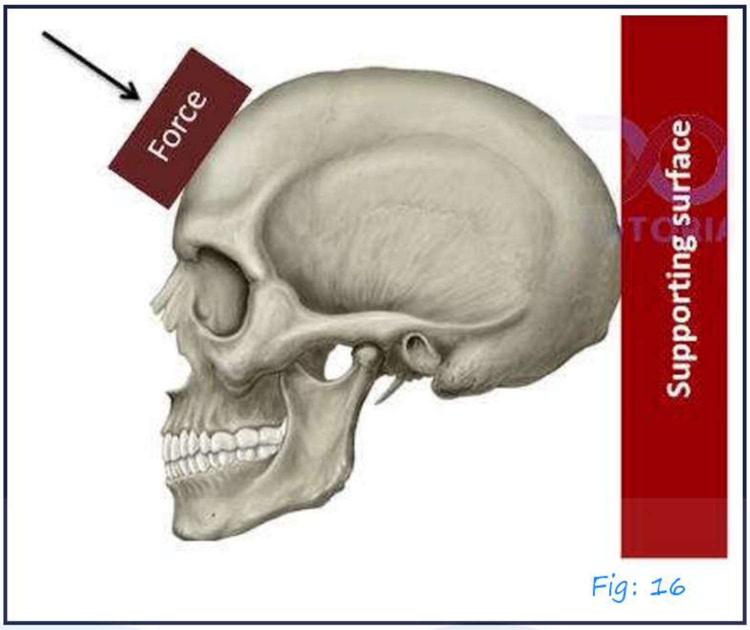

Force
Supporting surface

Fig: 16

Fractures of the base of the skull 00:18:23

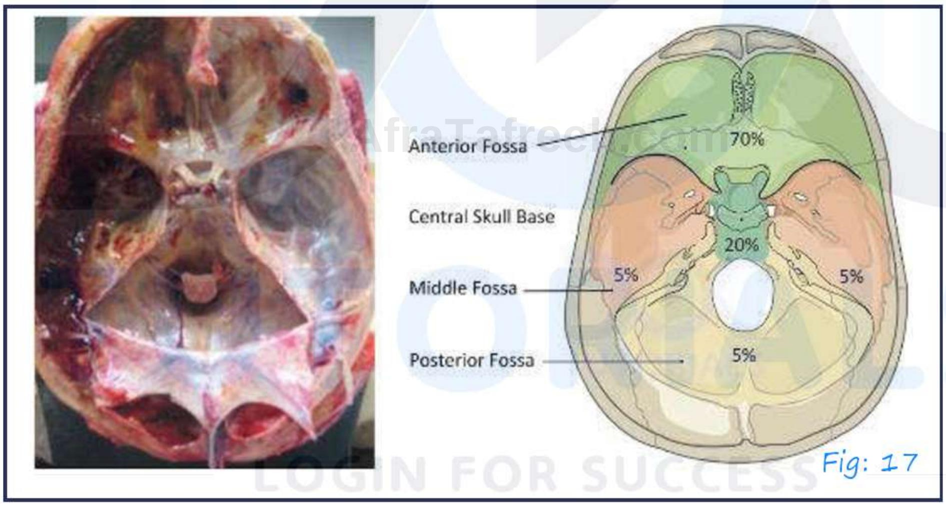

Anterior Fossa
Central Skull Base
Middle Fossa
Posterior Fossa
70%
20%
5%
5%
5%

Fig: 17

i. Fracture of Anterior cranial fossa

- In case of fracture of anterior cranial fossa, it gives rise to ectopic bruise in the form of black eye.
- There may be bleeding from the nose, mouth Or CSF rhinorrhoea.

ii. Fracture of Middle cranial fossa

- It gives rise to bleeding from the ear and also gives an ectopic bruise i.e. discolouration over the mastoid (purple or reddish discolouration) known as the **battle sign.**

iii. Fracture of Posterior Cranial fossa

- It may give rise to a boggy swelling over upper nape of the neck.

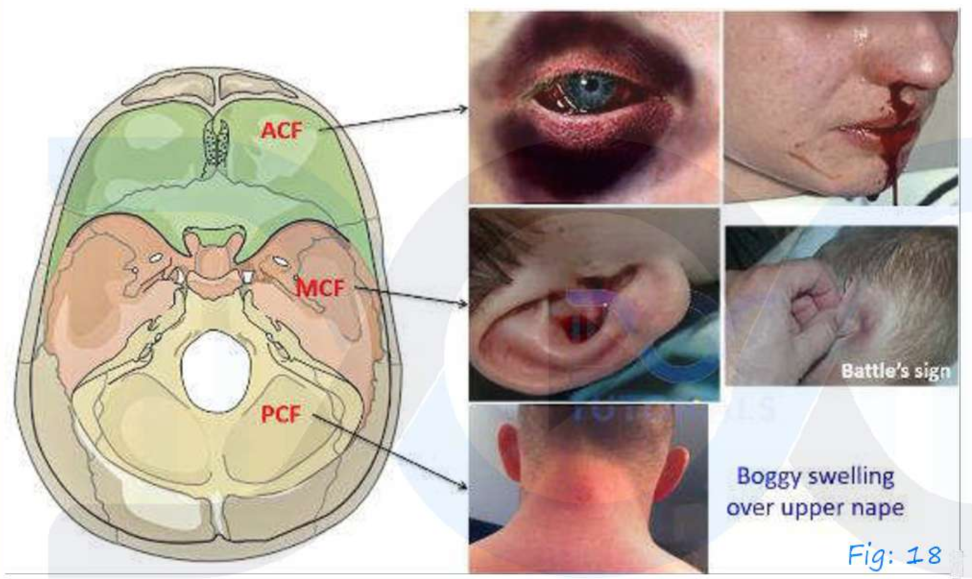

ACF
MCF
PCF
Battle's sign
Boggy swelling over upper nape

Fig: 18

Ring fracture

- It is a fracture around the foramen magnum, usually 3-5cm away from foramen magnum.

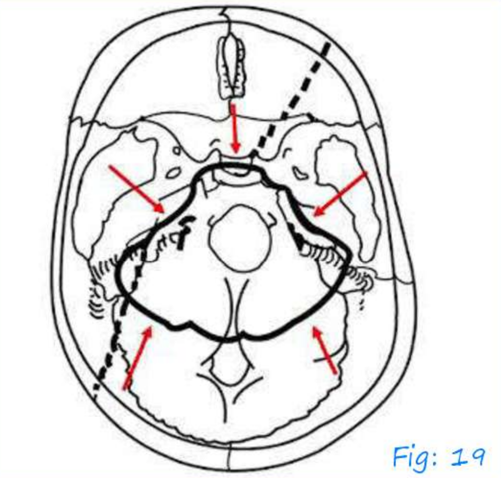


Fig: 19

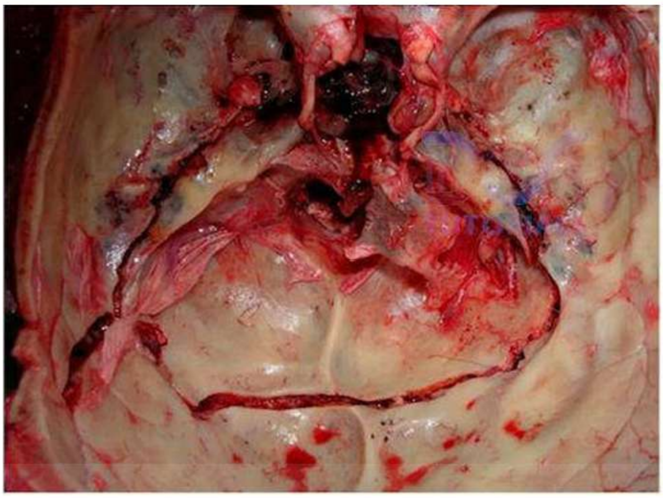
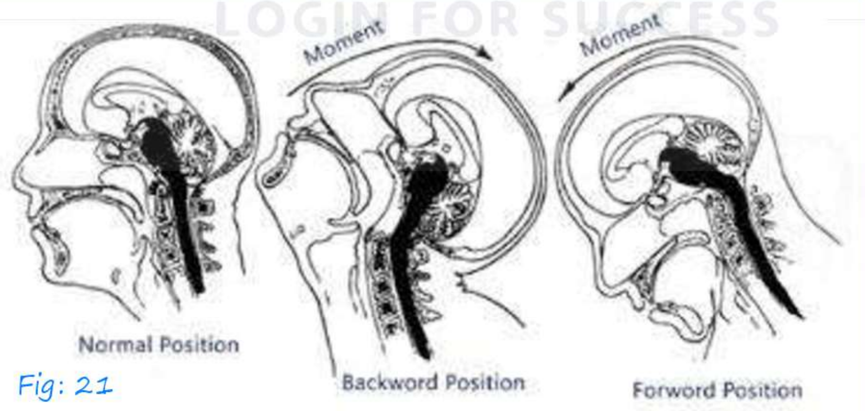


Fig: 20

- The cause for ring fracture is fall from the height on feet or buttocks, or by the fall of heavy object on the head or due to the blow on the chin.
- In case of fall from height on feet / buttocks there may be ring fracture + lumbar spine injury.

Hinge fracture 00:22:38

- There are 3 types



Moment
Moment
Normal Position
Backword Position
Forword Position

Fig: 21

Type I

- Coronal, passing through sella → most common
- Impact on side of head/tip of chin

- Known as motor cyclist's fracture

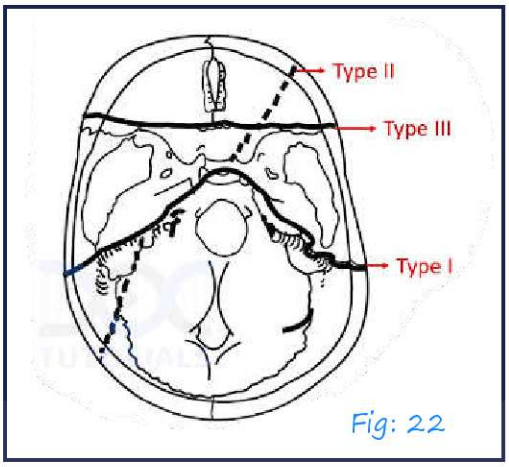

Type II
Type III
Type I

Fig: 22

Types II

- Front to back, passing through sella (oblique)

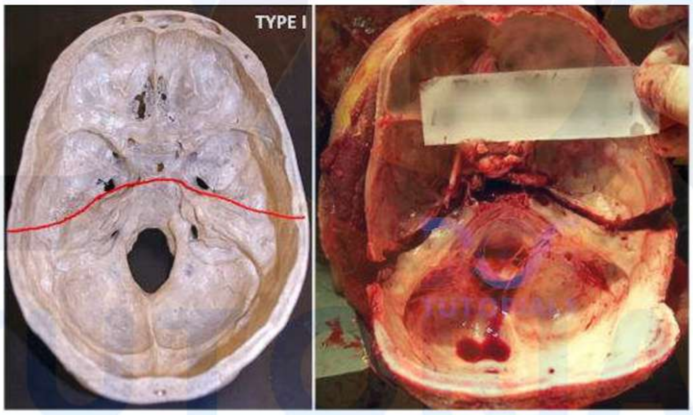


Fig: 23

Types III

- Coronal, but not through sella.

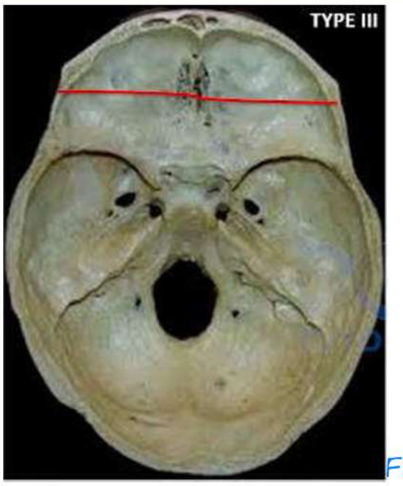


Fig: 24

- In case of skull fracture, there is no callus formation.

Cerebral injury 00:27:39

- There are 2 types

i. Stationary head

- Coup injury → At the site of impact

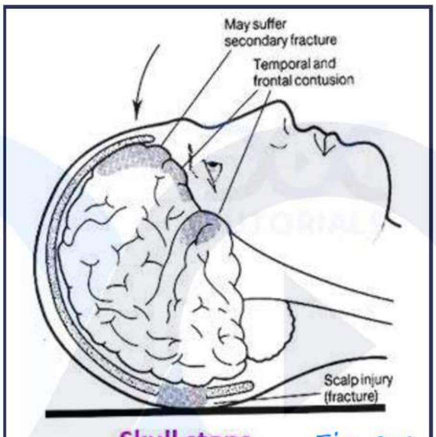

May suffer secondary fracture
Temporal and frontal contusion
Scalp injury (fracture)
Skull stops

Fig: 25

ii. Movable head

- Counter – coup injury → Injury sustained on the side opposite to impact

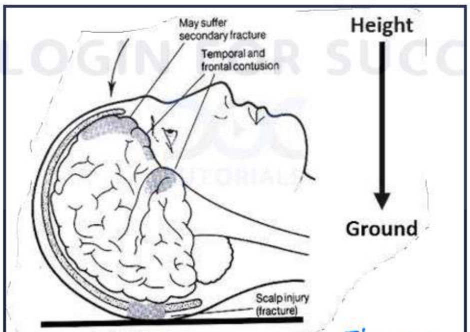

May suffer secondary fracture
Temporal and frontal contusion
Height
Ground
Scalp injury (fracture)
Skull stops

Fig: 26

- Movable head can have coup, counter coup and intermediary coup
- Intermediary coup → In between coup & counter coup

- Counter coup is most common in temporal &
- frontal and is almost unknown in occipital

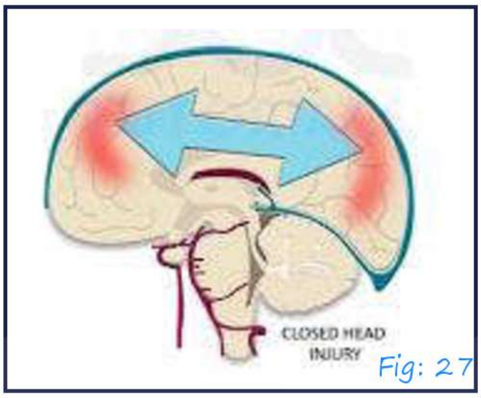


Fig: 27

- Counter coup injuries are rare before the age of 3 years
- Fall on temporal area may produce counter coup injury on ipsilateral lobe

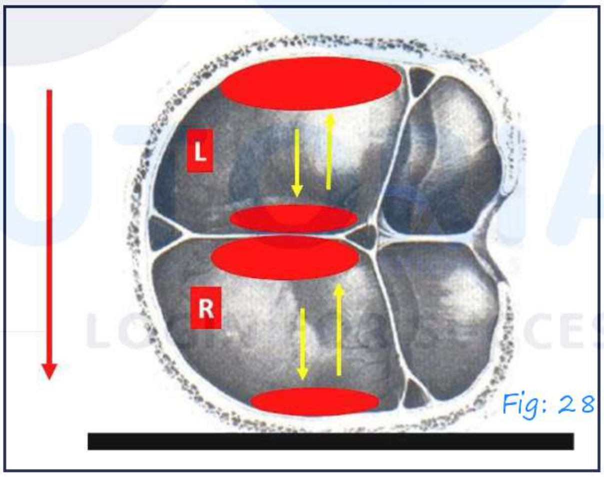


Fig: 28

Intracranial haemorrhages 00:36:24

Extradural haemorrhage (EDH)

- It is outside the dura
- The commonest source of bleeding is middle meningeal artery (posterior branch)

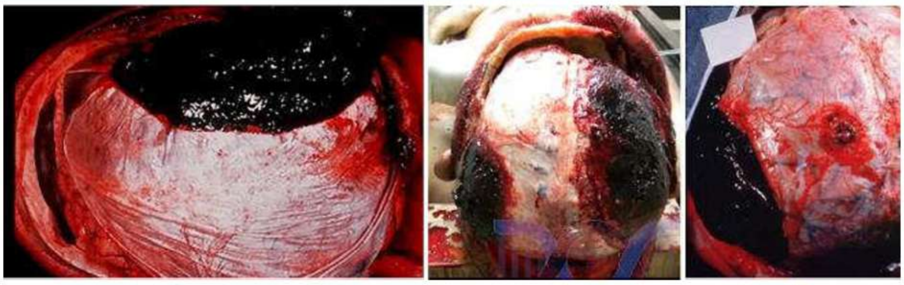


Fig: 29

- Commonest site → Temporo parietal area.
- About 85% of EDH is associated with skull #.

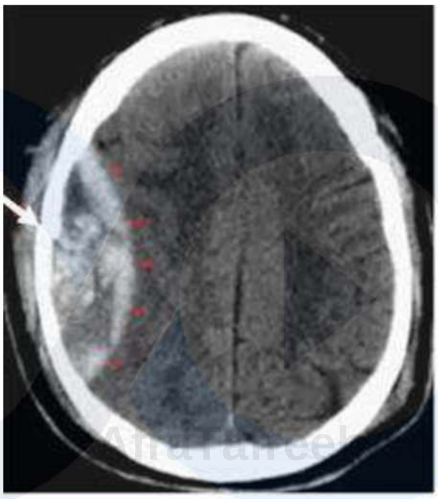


Fig: 30

- Minimum amount of blood required for symptoms in EDH is 35ml.
- Minimum fatal amount → 100ml
- Lucid interval is common/usually seen in EDH.
- In CT scan, EDH → biconvex

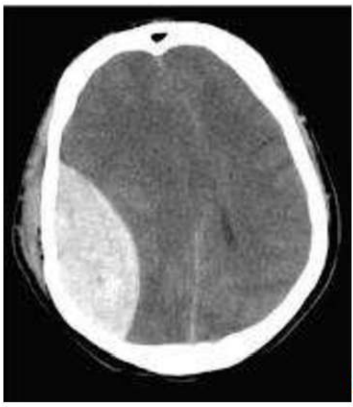


Fig: 31

- Common cause of death in EDH is respiratory failure.
- It is caused only by trauma.
- Extradural haemorrhages may give rise to few conditions like:

i. Tentorial coning of Jefferson

- Herniation of temporal lobe (uncus)

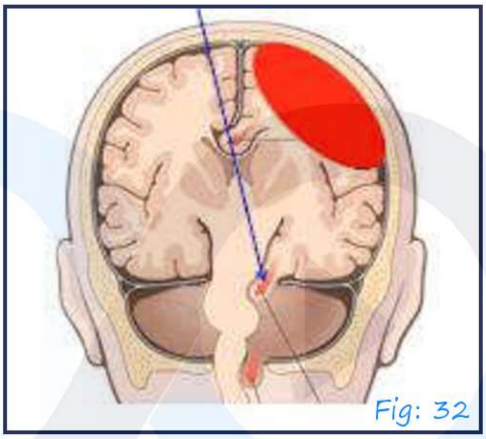


Fig: 32

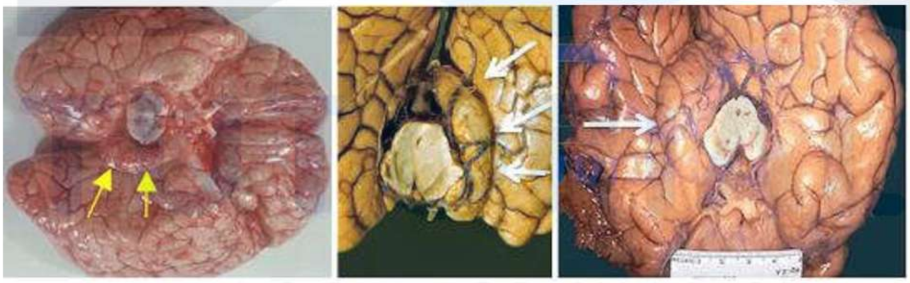


Fig: 33

ii. Cerebellar coning of cushing

- Herniation of cerebellar tonsils

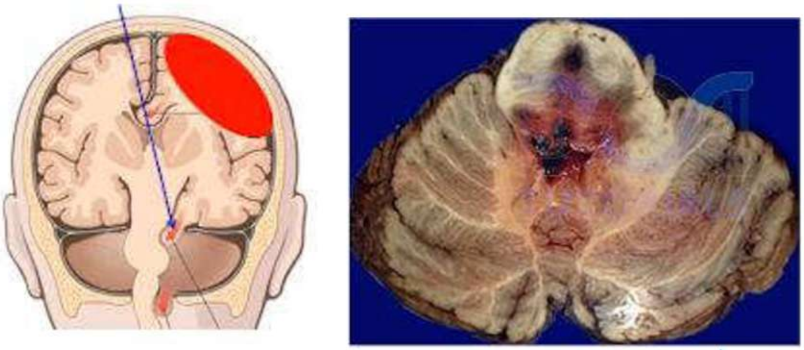


Fig: 34

iii. Duret haemorrhages

- Gliding contusion in midbrain & upper pons

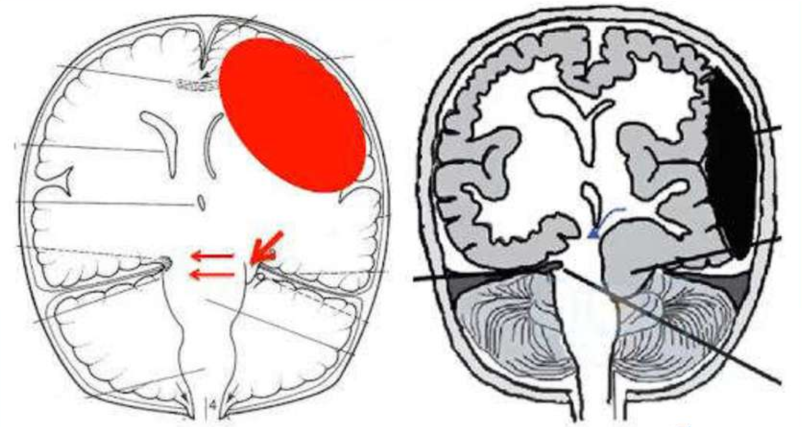


Fig: 35

iv. Kernohan's notch

- Indentation of cerebral peduncle which is seen on the opposite side

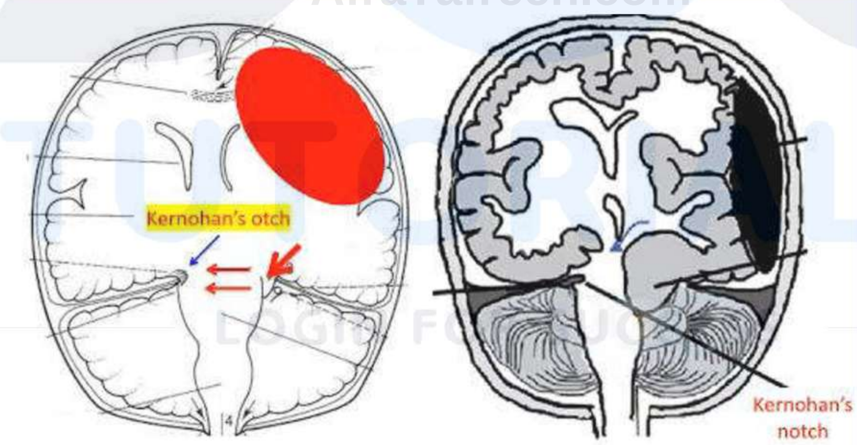

Kernohan's otch
Kernohan's notch

Fig: 36

Subdural hemorrhage

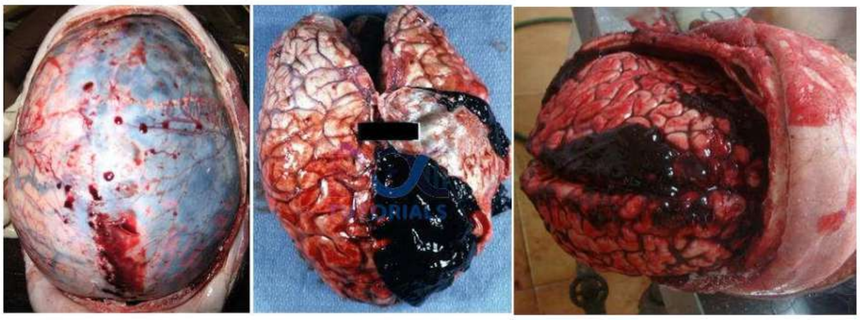


Fig: 37

- It is caused almost by trauma.
- Commonest source of bleeding is rupture of bridging veins.

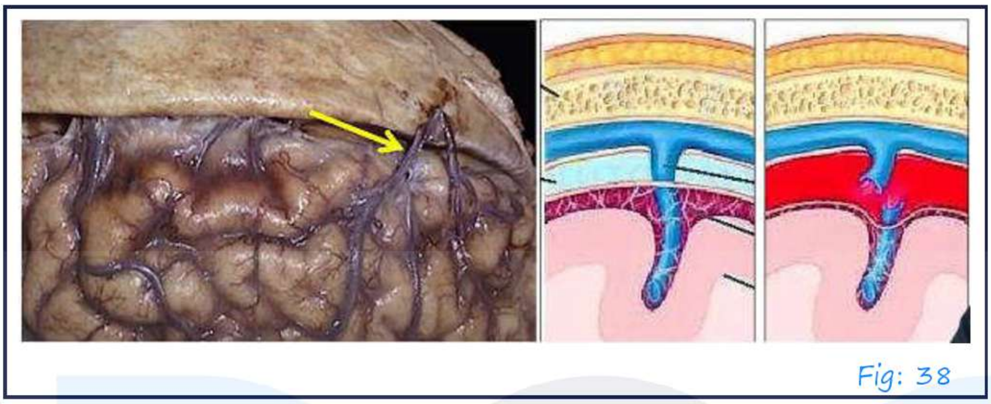


Fig: 38

- Commonest site → front to-temporo-parietal region
- Minimum fatal amount = 100-150ml
- SDH is commonly seen in
  - Elderly people → due to cerebral atrophy
  - Alcoholics → cortical thinning

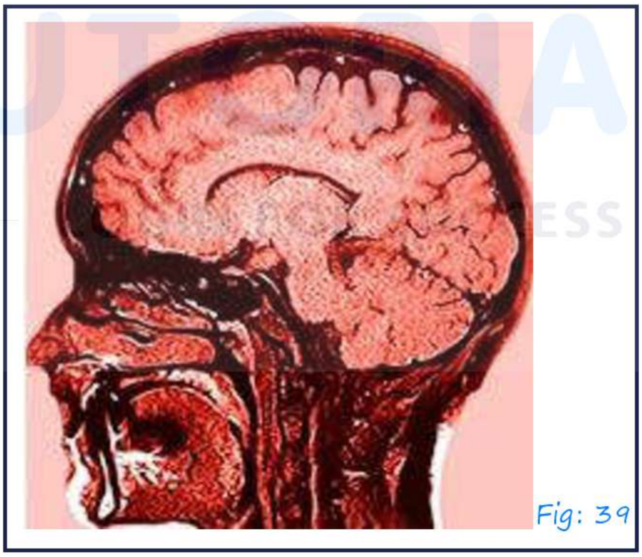


Fig: 39

- Both in cerebral atrophy & cortical thinning, the bridging vein becomes taut.

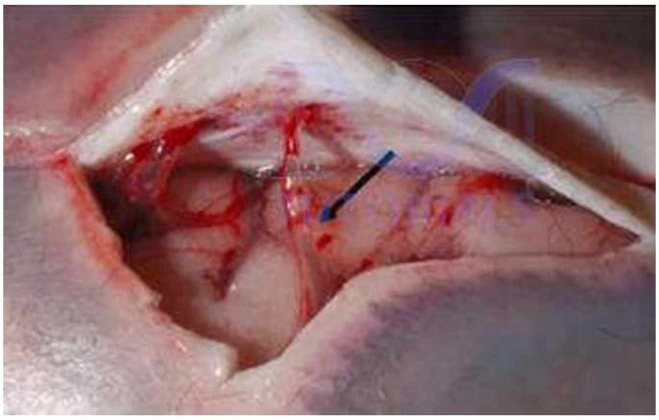


Fig: 40

- Child abuse → shaken baby syndrome

- It is the most common haemorrhage in boxers.

Boxers haaemorrhage

- Pontine haemorrhage is known as boxers' haemorrhage.

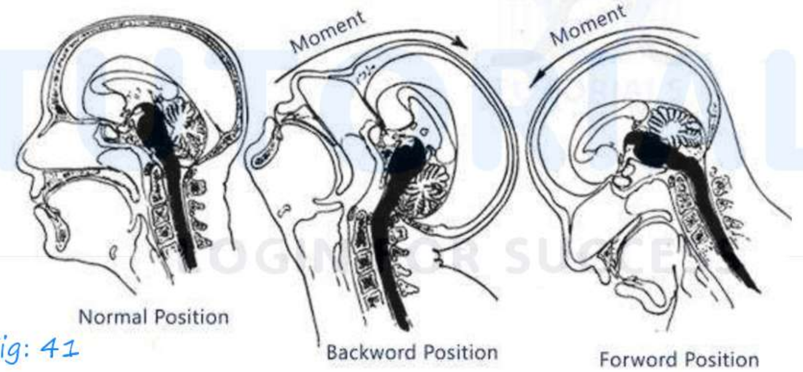

Moment
Moment
Normal Position
Backword Position
Forword Position

Fig: 41

- Boxer's fracture is the fracture of the metacarpals.

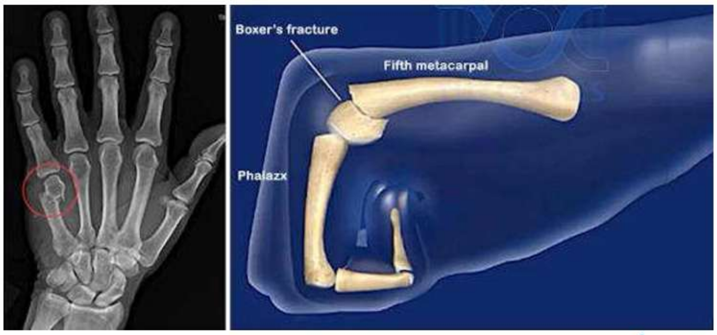

Boxer's fracture
Fifth metacarpal
Phalazx

Fig: 42

- Punch drunk syndrome is seen in boxers.
- **CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)** – known as dementia pugilistica or 'punch drunk syndrome'

Subarachnoid haemorrhage (SAH) 00:54:49

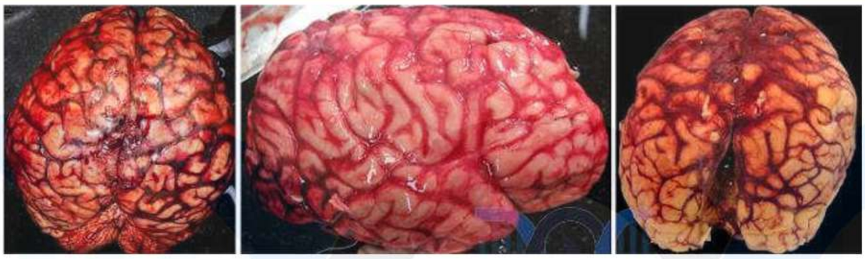


Fig: 43

- It may be caused by the rupture of
  - Aneurysm
  - Bridging veins
  - Cortical arteries
- Most common site of rupture of berry aneurysm is anterior communicating artery.
- Immediate minimal fatal amount → 30ml
- Caused by trauma or disease.

Intracerebral haemorrhages 00:57:08

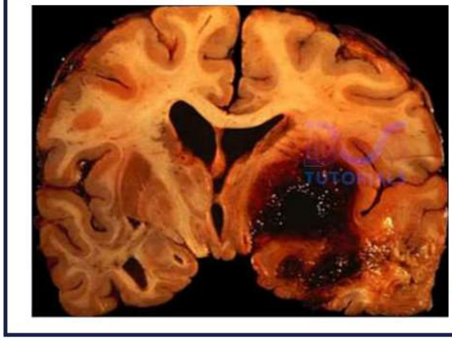


Fig: 44

- Most common in elderly hypertension individuals.
- Most common in cause → Rupture of charcot's artery (Lenticulo-striae branch of MCA).

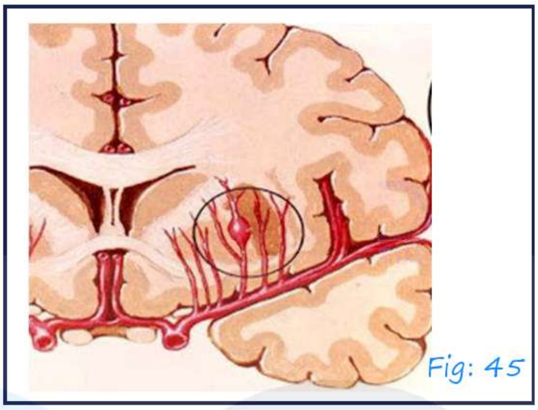


Fig: 45

- Most common site → Putamen
- Caused by trauma or disease.
- Most common form to traumatic intra-cranial haemorrhage is sub-arachnoid.

  (SAH > SDH > EDH)
- Most common form of traumatic intra-cranial lesion is cerebral contusion.
- Most common non traumatic intra-cranial haemorrhage is intracerebral haemorrhage.
- Transient amnesia and unconsciousness is characteristic of concussion (Cerebral concussion is a state of temporary unconsciousness immediately following head injury, and is always followed by amnesia, and tends to spontaneous recovery)
- Retraction ball necrosis is associated with diffuse axonal injury
- The earliest histological evidence of DAI is

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- Retraction balls/globes
- Seen after 12-18hours after injury

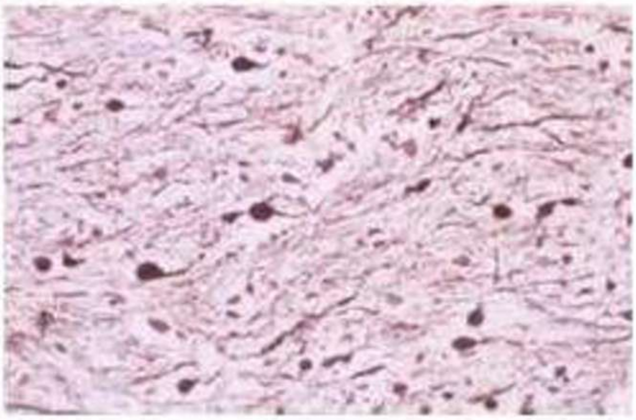

Fig: 45

- The chamber of the heart most prone to penetrating injury is right ventricle.
- Left ventricle bleeds comparatively less in case of a stab injury over it.
- Survival chances are better if the blade of the knife penetrates into left ventricle.
- Commonest site of traumatic cardiac rupture is right atrium.
- The commonest site of traumatic aortic rupture is Isthmus or Descending thoracic aorta
- Minimum amount of blood to give rise to death by acute cardiac tamponade is 200ml.
- Amount of air necessary to produce fatal air embolism is 100ml.

Commotio cordis 01:07:08

- Involves young (8–18 years; average age is 15 years)
- Predominantly male, athletes
- Sudden blunt trauma to the anterior chest results in death from ventricular fibrillation

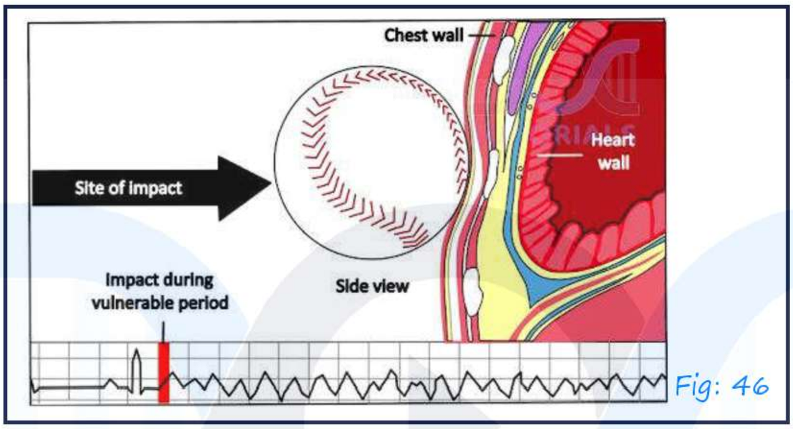
Chest wall
Heart wall
Site of impact
Impact during vulnerable period
Side view

Fig: 46

- The most likely organ to be damaged in blunt abdominal trauma is liver
  - Liver is the most likely organ to be damaged in blunt abdominal trauma and is second only to the brain in overall visceral susceptibility
- The commonest organ involved in penetrating abdominal injury small intestine
- The commonest site of traumatic tear of intestine is jejunum
- The minimum number of casualties to consider mass disaster is 12
- Berlin's edema is associated with retinal concussion

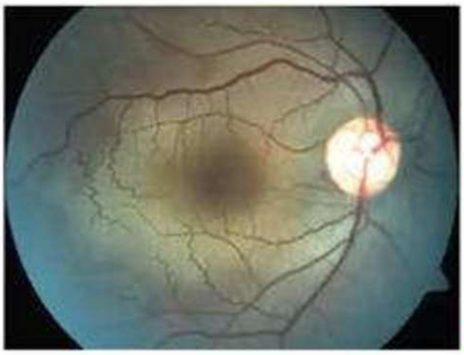

Fig: 47

Extra Edge topics 01:09:58

- Pachy Meningitis Hemorrhagica:
  - It is a chronic subdural hemorrhage
- Subdural hygroma:
  - Accumulation of CSF in subdural space due to rupture of arachnoid layer.
- Most commonly affected bone in basal fractures of the skull is
  - Sphenoidal fissure
- Fracture of middle cranial fossa causes injury to
  - VI and VII cranial nerves
- The part of the brain most likely to show evidence of damage in hypoxic brain injury is
  - Hippocampus
- Burst lobe means
  - Combination of extensive contusion and an associated SDH
- Plaque Jaunes (Yellow plaque) is
  - Old healed cortical contusions
- In case of whiplash Injuries, most cervical spine fractures occur predominantly at two levels
  - at the level of C2 or at C6 or C7

- Railway spine means
  - Concussion of the spinal cord
  - There will be transient paralysis with usual recovery within over 48 hours
- Spinal injuries are immediately fatal,
  - If the fracture occurs above the level of C4
- Most commonly injured part of the spinal cord is
  - Cervical
- In commando punch, injury usually occurs in the neck
- 'Pincer contusions' may be seen in trauma to the lungs
  - Bleeding in the lungs expands the lower margins which gets trapped in the narrow costophrenic angles
- Ewing postulates concerns with
  - Growth at the site following trauma (Relation between trauma and tumor)
- Triage
  - Is the sorting out and classification of casualties of war or other disasters
  - To determine priority of need and proper place of treatment
- The organ not usually injured in case of blunt abdominal injury is
  - Non-gravid uterus
- "Tiger skin abrasion" injuries are associated with Aircraft explosion
- The callus is visible on X-ray at 3 weeks

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ROAD TRAFFIC ACCIDENT

Injuries to pedestrian 00:00:21

i. Primary impact injuries

- Injures caused due to initial impact.

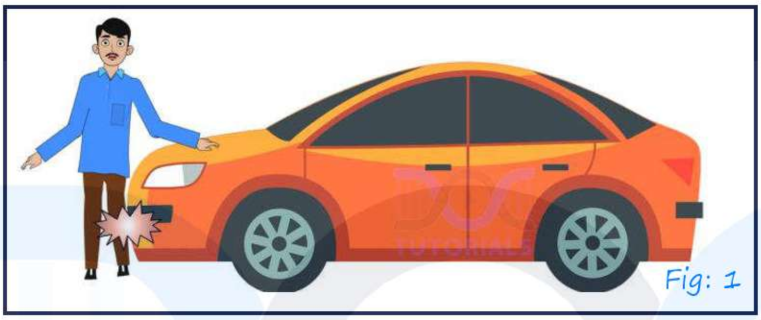

Fig: 1

- Most common bone to be fractured is tibia → wedge shaped fracture → Apex shows the direction
- If brakes are applied → Height of bumper dips down

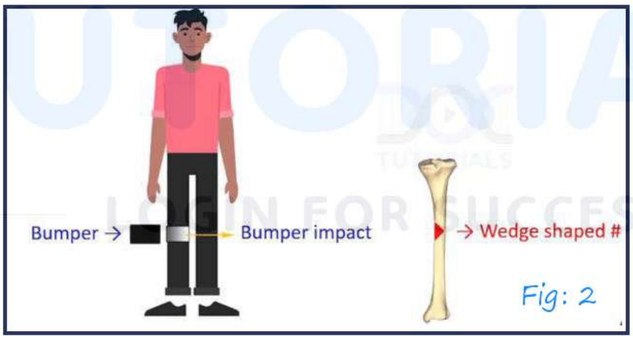
Bumper →
Bumper impact
→ Wedge shaped #

Fig: 2

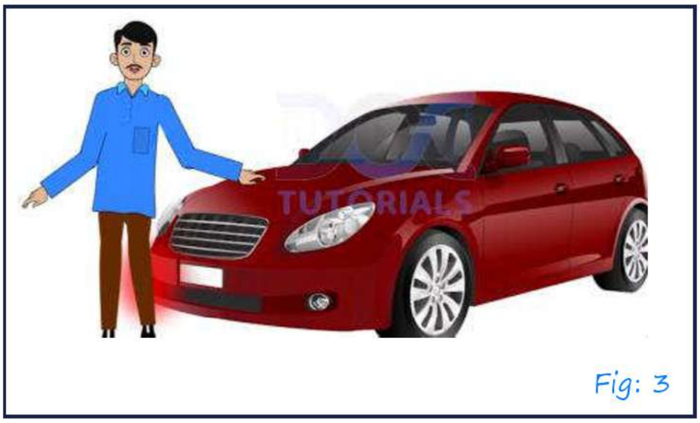

Fig: 3

- Bumper fracture → Fracture of lateral tibial plateau

ii. Secondary impact injuries

- By falling over the vehicle.

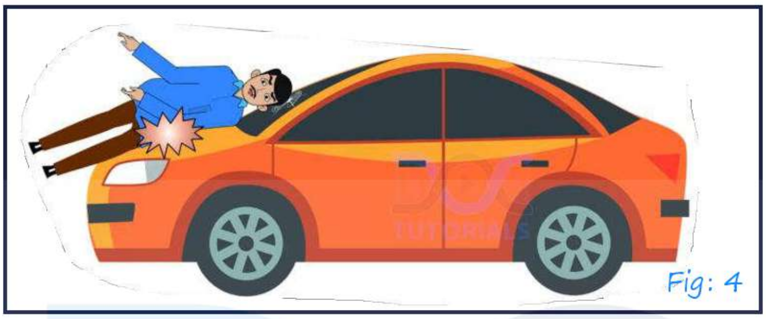

Fig: 4

iii. Secondary injuries or tertiary injuries

- It is caused by falling over the ground.

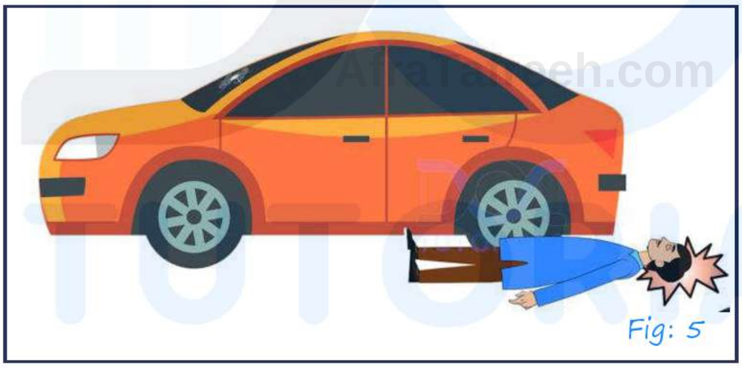

Fig: 5

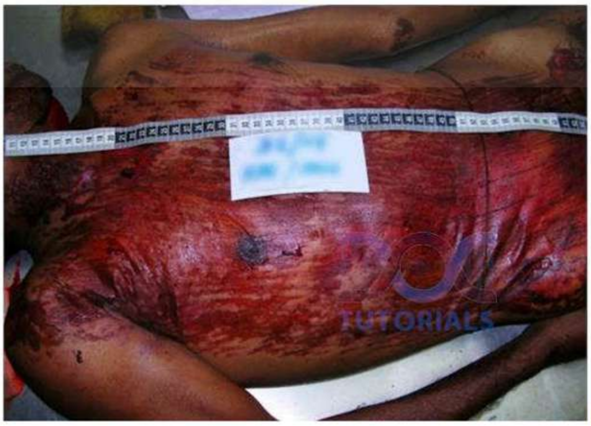

Fig: 6

Waddell's triad

- Primary impact + secondary impact + tertiary injuries

iv. Run over injuries

- By tyres passing over the person.

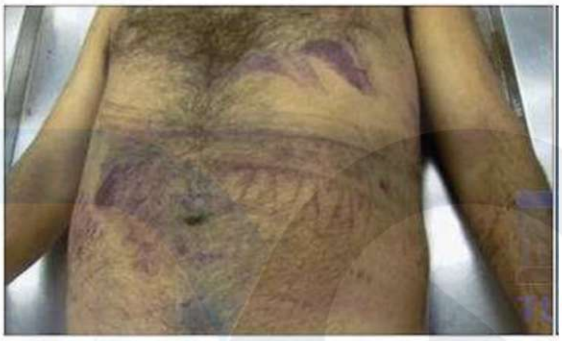

Fig: 7

Rolling injuries 00:06:50

- These are the injuries sustained by a pedestrian as a result of being rolled between the ground and under surface (chassis) of the vehicle → vehicle with low chassis.
- **Bicycle spoke injuries** are most commonly seen in foot

Injuries to occupants 00:08:51

i. Sparrow feet lacerations/dicing injuries

- They are multiple, small, irregular, superficial lacerations over face & neck (uncovered by cloth).
- It is due to broken windshield glass.

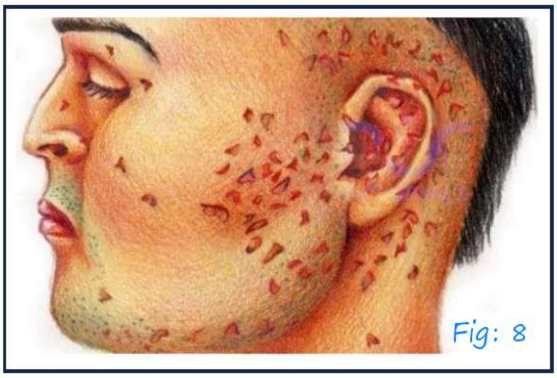

Fig: 8

- It is sustained by driver & front seat passengers (equal chances).

ii. Whiplash injury

- It is caused by either
  1. Acute hyperextension followed by acute hyperflexion or
  2. Acute hyperflexion followed by acute hyperextension.
- 1 is more dangerous than 2.
- It is due to the tear of anterior longitudinal ligament.
- There will be dislocation or fracture dislocation of cervical vertebrae with laceration of spinal cord without any external evidence.

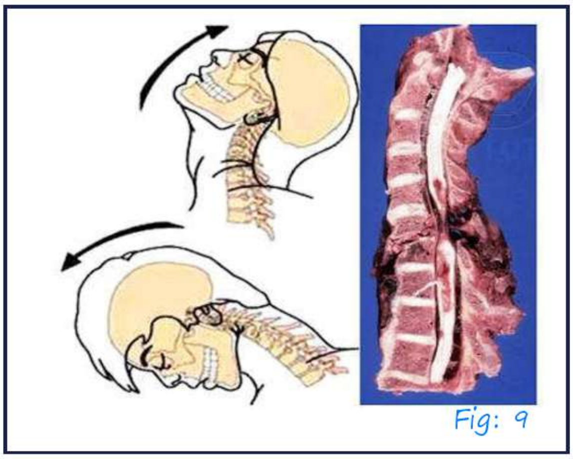

Fig: 9

- Whiplash injury is less common in driver because he is more alert at the time of impact and stabilizes his neck.

iii. Deceleration injuries in drivers

- Rupture of the aorta → Most common location is aortic isthmus/ descending thoracic aorta.

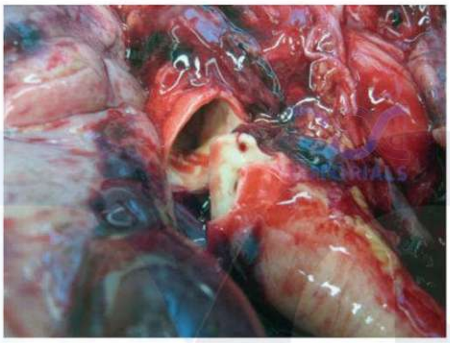

Fig: 10

Ladder rung tears

- Multiple transverse parallel tears in the intima of aorta adjacent to main rupture.

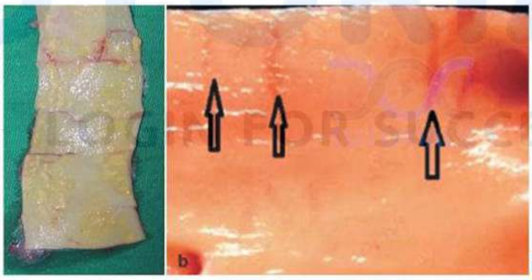

Fig: 11

iv. Seat belt injury

- Deceleration force cause tear in the mesentery & small intestine in both driver & passengers.
- Compressive force may cause injury to spleen in case of driver and injury to liver in case of Front seat passenger.

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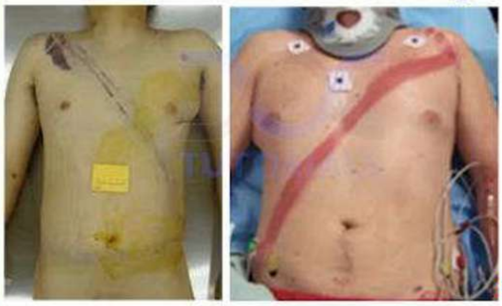


Fig: 12

- Overall, the most common organ to be involved is mesentery & small intestine.
- In lap belt injury, compression between the lap belt and vertebrae causes tear in the mesentery and intestine.
- Lap belt injury to the spine is Flexion distraction injury → Thoraco-lumbar vertebral fractures → k/a Chance fracture

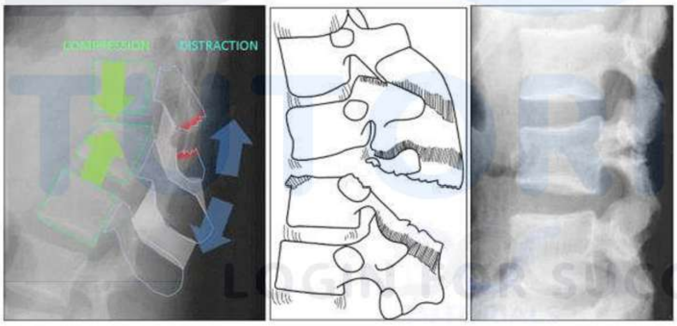


Fig: 13

Airbag Injuries

- Airbag reduces the fatality by about 14%
- Together with seatbelt it reduces the fatality by around 50%
- However, airbag deployment itself may cause injuries to a number of parts of the body

- In current vehicles rare seat passengers sustain more injuries than front seat passengers

Tail gating

- A small vehicle is driven/ridden too closely behind a larger vehicle at a high speed.

Under running

- When larger vehicle stops suddenly, smaller vehicle continues to run under larger vehicle.

Fig: 14

Back seat passengers

- Sustain injuries to the head and knees
- By striking the front seat

THERMAL INJURIES

Cold 00:00:22

- Hypothermia is said to exist when rectal temperature is less than 35°c.
- Below 32°c → shivering stops
- Below 30°c → hypothalamus fails to regulate temperature
- Below 26°c → or less for 24hours is fatal
- Stress ulcer seen in case of hypothermia is known as Wischnewsky ulcer.

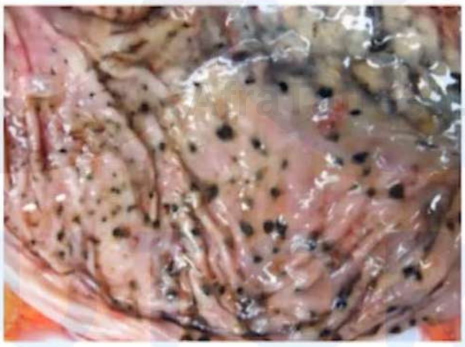


Fig: 1

- Fat necrosis of pancreas is most constant findings in death due to hypothermia.

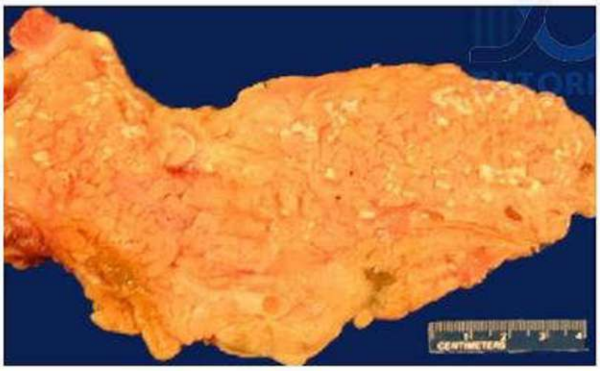


Fig: 2

Hypothermia 00:02:20

Hypothermia

↓

Failure of hypothalamus (>30°c)

↓

Reflex vasodilatation

↓

Warm feeling

↓

Removal of clothes (Paradoxical undressing)

↓

Tend to hide in enclosed spaces

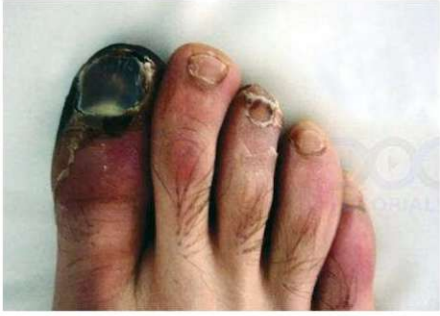
↓

Hide and die syndrome/terminal burrowing behaviour

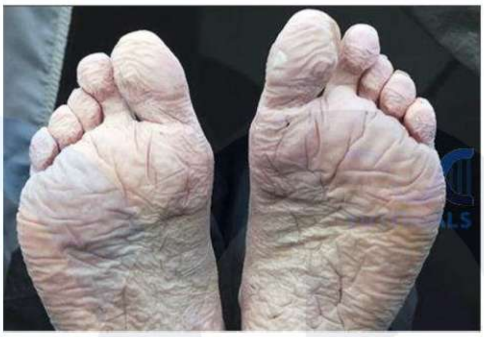
Injuries due to cold 00:05:02

- With tissue freezing (<0°)
  - Frost nip → Early stage of frost bite
  - Frost bite → Skin becomes hard & black in about 2 weeks
- Without tissue freezing (>0°c)
  - Trench foot/immersion foot (5-8°c)
  - Chilblains/pernio/perniosis

Frostnip Fig: 3



Frost bite Fig: 4



Trench foot/immersion foot Fig: 5

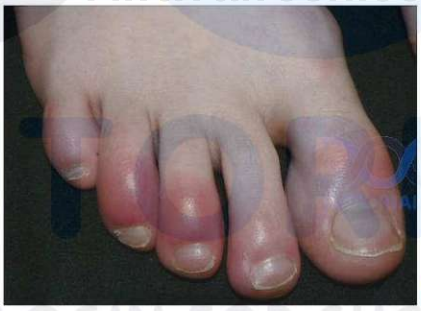


Fig: 6

Chilblains/Pernio/Perniosis

Heat 00:07:49

- Body temperature increase in case of heat stroke.
- The minimum core body temperature for heat stroke to occur is 40.5°c.
- Sweating is absent in heat stroke.

Burns 00:09:23

- Minimum temperature required for producing burns is 44°c → for 5-6hours exposure.

Dupuytren's classification of burns 00:10:06

- 1st degree burns → Erythema

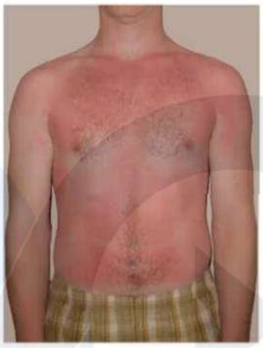


Fig: 4

- 2nd degree burns → blister formation

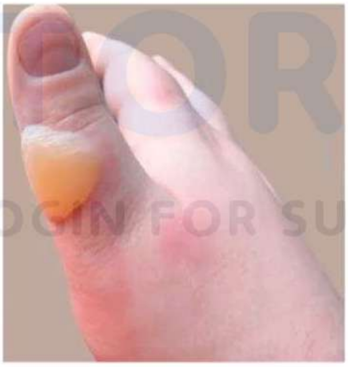


Fig: 5

- 3rd degree burns → destruction of superficial layer of dermis → Most painful

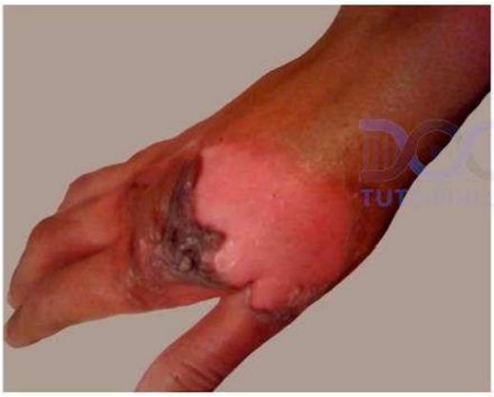


Fig: 6

- 4th degree → destruction of whole skin → painless

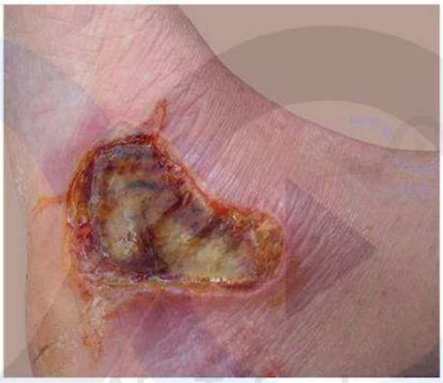


Fig: 7

- 5th degree burns → destruction of fascia & muscles painless
- 6th degree burns → charring involving vessels, nerves, bones painless

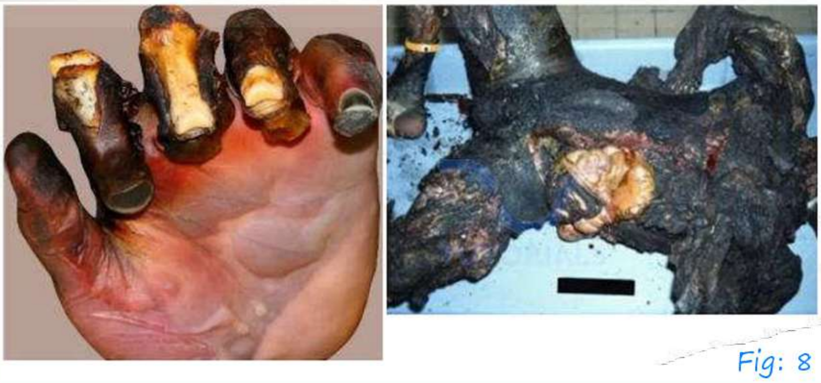


Fig: 8

Dupuytren's	2. WILSON's	3. HEBRA's
1st and 2nd	Epidermal	1st degree
3rd and 4th	Dermo-epidermal	2nd degree
5th and 6th	Deep	3rd degree

Estimation of body surface area burn 00:13:28

Adults – Wallace rule (Rule of nine) 00:13:37

- Head + Neck = 7+2= 9
- Arm + Forearm + Hand = 4+3+2= 9
- Thigh + Leg + Foot = 10+5+3= 18

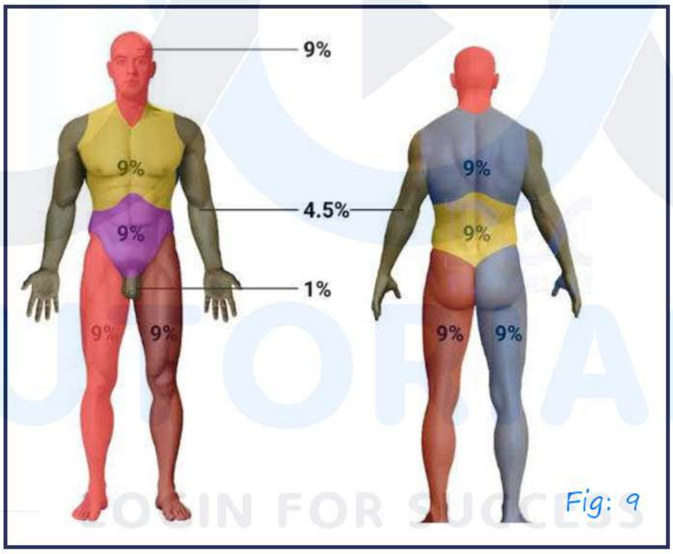


Fig: 9

- Patient's palm with fingers ≈ 1% of body surface area

Children & adults – Lund & Browder chart 00:17:11

- It is the best to estimate BSA burn in both children and adults

Area	Age 0	1	5	10	15	Adult
½ of head	9.5	8.5	6.5	5.5	4.5	3.5
½ of thigh	2.75	3.25	4	4.5	4.5	4.75
½ of leg	2.5	2.5	2.75	3	3.25	3.25

Fixed parts (0-18years)

- Neck: 2%
- Upper limb: 10%
- Front of trunk: 13%
- Back of trunk: 13%
- Buttocks: 2.5 + 2.5= 5%
- Foot: 3.5%

Face < ½ of head

- Commonest cause of death in burns is secondary shock.
  - More than half of deaths from burns occur within the first 48hours usually from secondary shock, due to fluid loss from burned surface.

Definite signs of death due to burns 00:24:50

- Soot in trachea

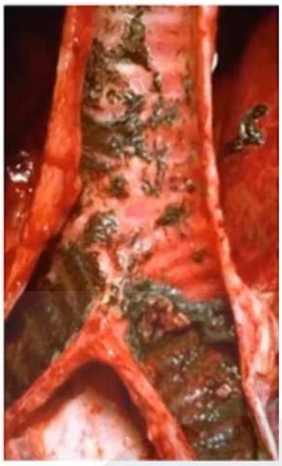


Fig: 10

- Blister (vesicle) containing albumin, RBC, WBC and Cl⁻ with red line.

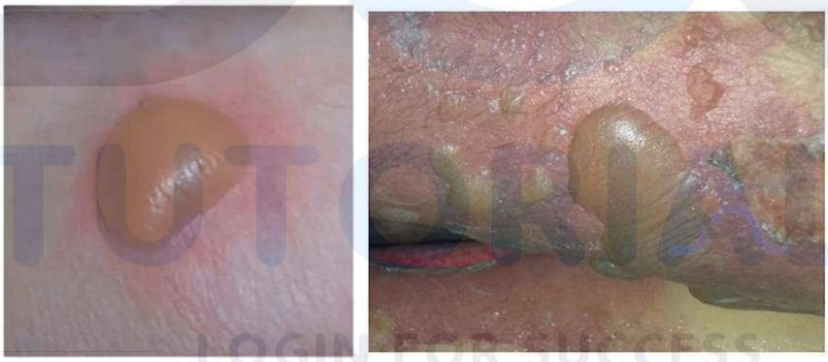


Fig: 11

- >10% COHb (carboxy Hb)
  - (Surest sign: Presence of CoHb + external burns)
- **Blisters in putrefaction and postmortem burns**

Trait	Putrefaction	Postmortem burns
Hyperemia	Absent	Absent
Base	Pale	Pale, dry and hard
Contents	Mostly air, may contain fluid but transudate sometimes pink-red serous fluid	Air

- Features of ante-mortem burn
  a. Vesicles with hyperemic base or red line
  b. PUS
  c. High protein content
- Minimum percentage of carboxy Hb required for cherry red discolouration of blood is 40%.

DOC TUTORIALS
LOGIN FOR SUCCESS

Pugilistic attitude 00:32:18

- Also known as boxing (or) defence (or) fencing attitude/posture

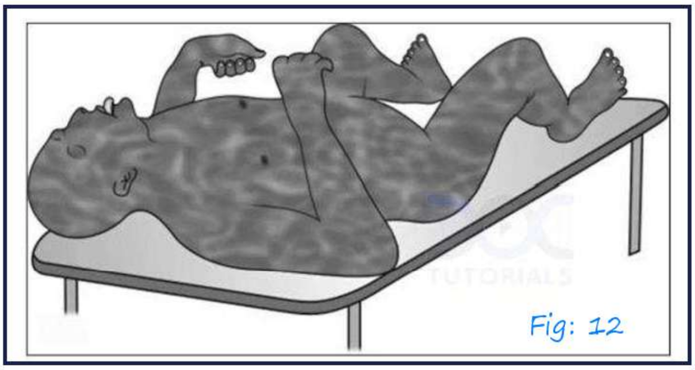


Fig: 12

- It is due to coagulation of muscle proteins.
- It is seen in case of burns where the body attains universe flexion except back, head is slightly extended.
- Often the joint spaces are exposed, and articulating surfaces are charred

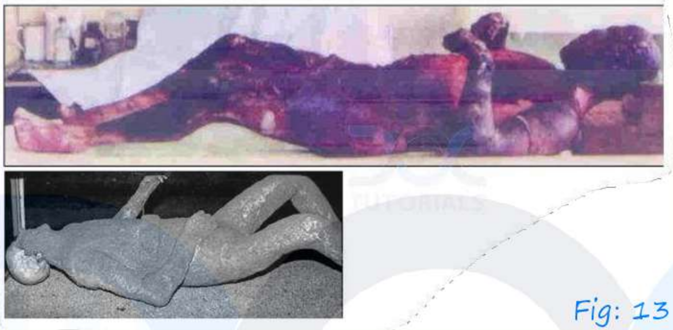


Fig: 13

- Seen both in AM and PM burns.
- Heat stiffening in the muscles occur above the temperature of 75°C.

Heat hematoma 00:37:11

- It is due to the rupture of dural venous sinuses and from emissary veins (dipole).

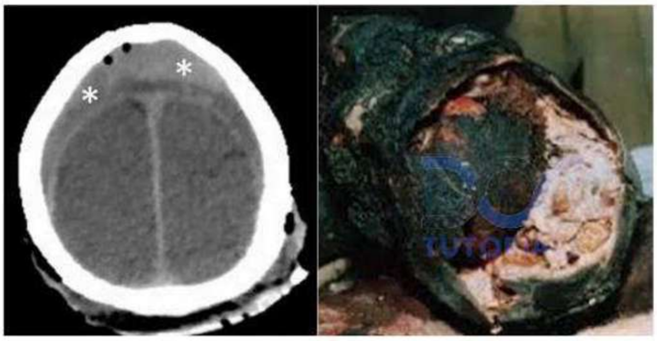


Fig: 14

- Heat hematoma resemble extra-dural haemorrhage.

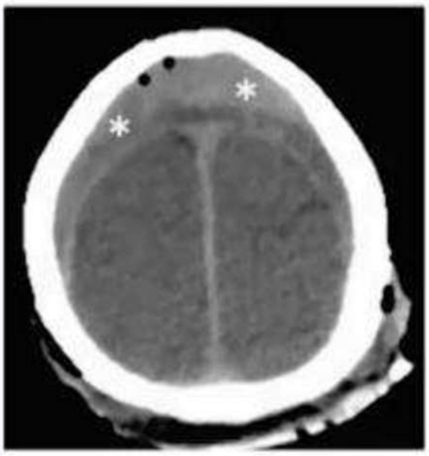


Fig: 15

- Heat hematoma is seen between dura & skull.
- Most common site → parietotemporal
- It is soft & friable, light brown in colour (may be cherry red if blood contains (o)

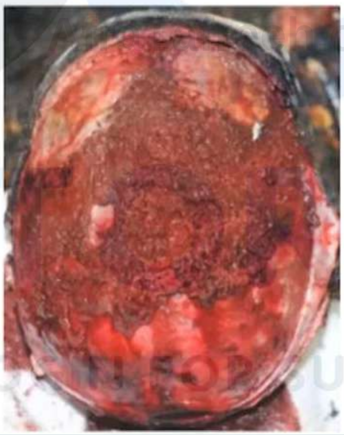


Fig: 16

- It has honeycomb appearance on cut section, due to air bubbles .
- Thickness → 1.5mm to 1.5cm, upto 120ml

DOT TUTORIALS .com LOOK FOR SUCCESS

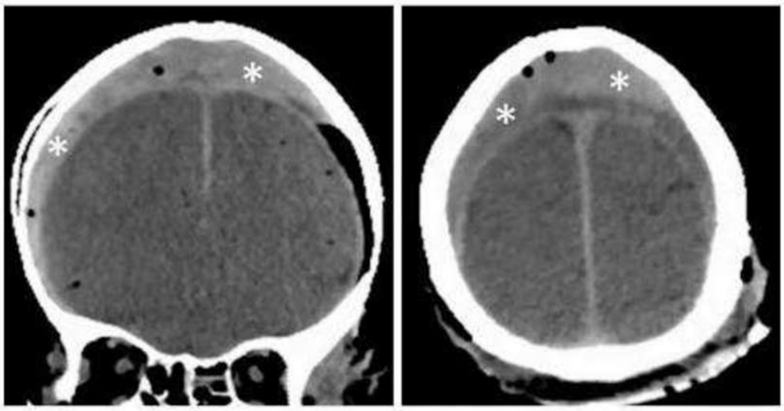


Fig: 17

Heat fracture 00:40:18

- Bursting fracture
  - Due to steam pressure.
- Surface fracture
  - It is due to rapid drying & contraction .

Fig: 18

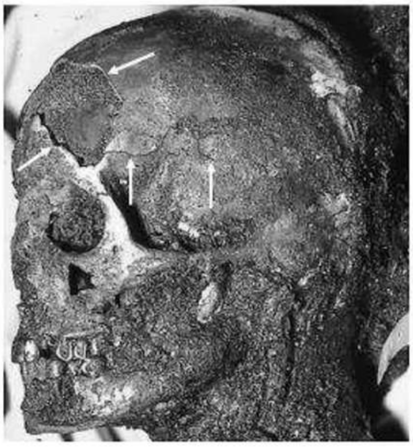


Fig: 19

- Minimum 20 minutes heat application is required.
- Involves only outer table.
- Uni/bilateral, stellate & may cross the sutural line .

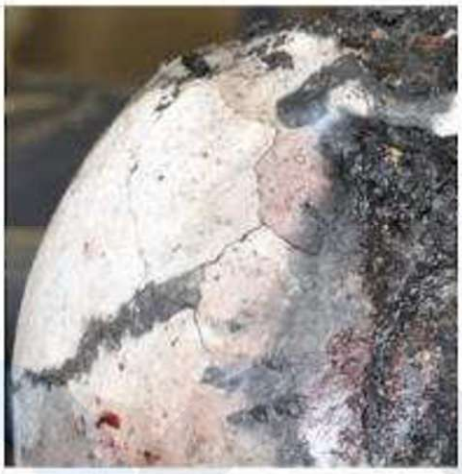


Fig: 20

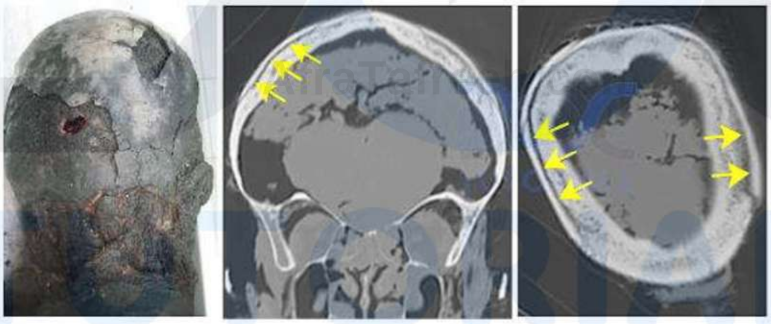


Fig: 21

- Curved fracture

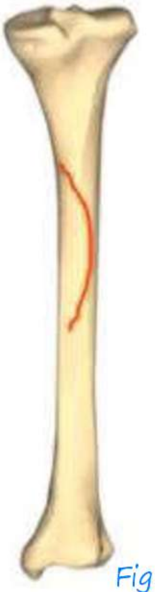


Fig: 22

- Street & avenue

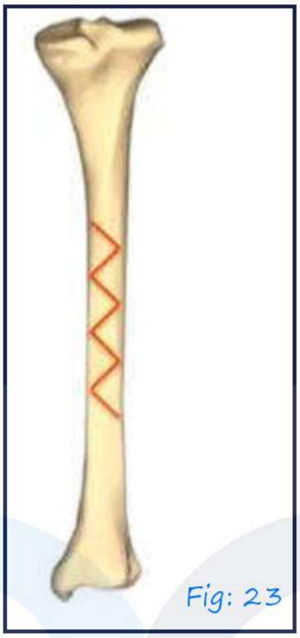


Fig: 23

Inhalational burns 00:45:03

- It includes
  - Hypoxia → Flame utilize the available oxygen.
  - Hoarseness of voice and stridor → Hot air injuries the laryngeal mucosa.
  - Soot deposition in air passage → due to flying ashes
  - Yellow sputum → oxides of N_2 converts the sputum into yellow.

Crow's feet sign 00:49:48

- Areas without burns/soot deposits.
- Due to non-penetration of smoke/burns into the base of wrinkles → Angle of eye and forehead.

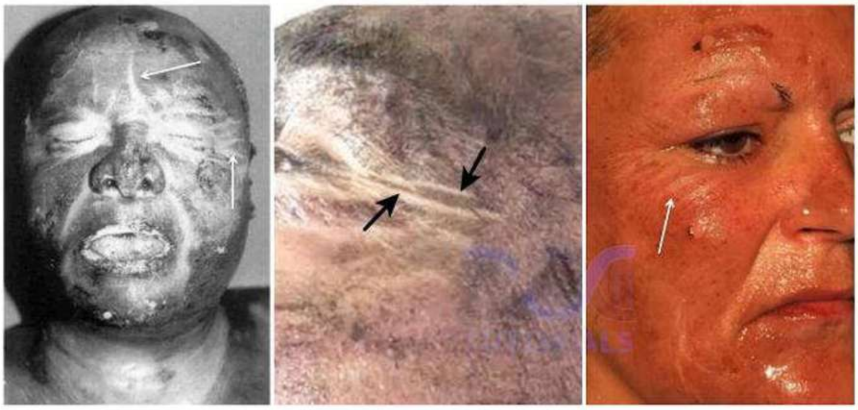


Fig: 24

- Indicates that the person was aware at the time of burns.

Scalds 00:52:22

- It is caused due to the application of moist heat (liquid about 60°c) or steam.

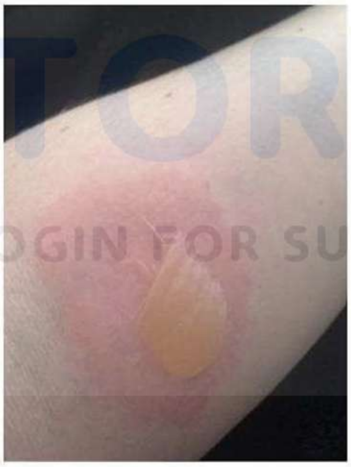


Fig: 25

- 1st degree → erythema
- 2nd degree → blister formation
- 3rd degree → necrosis of dermis
  - No blackening
  - No charring

- No singeing
- Skin → saddened and bleached

Types:

1. Immersion burns:
   - D/t immersion in hot liquid
   - Line of demarcation corresponding to the water level may be seen

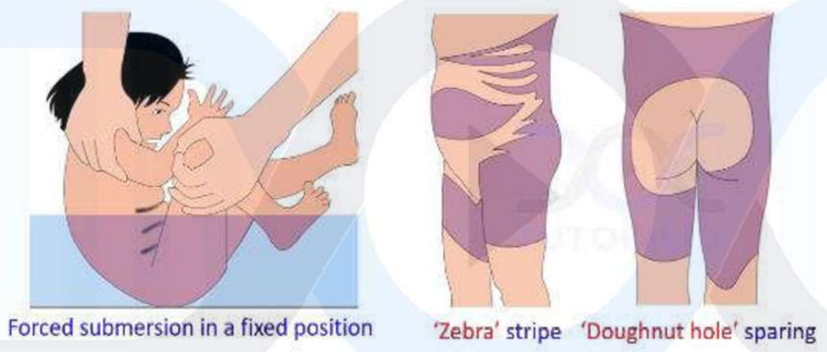

Forced submersion in a fixed position
'Zebra' stripe
'Doughnut hole' sparing

Fig: 26

2. Spill burns or splash burns:
   - D/t spillage or throwing hot liquid
   - Trickle Pattern in Accidental Scalding

3. Steam burns
   - D/t exposure to hot steam

Electrical injuries 00:57:08

Joule burns

- Also known as endogenous burns.
- It is an electrical burn at the point of entry.

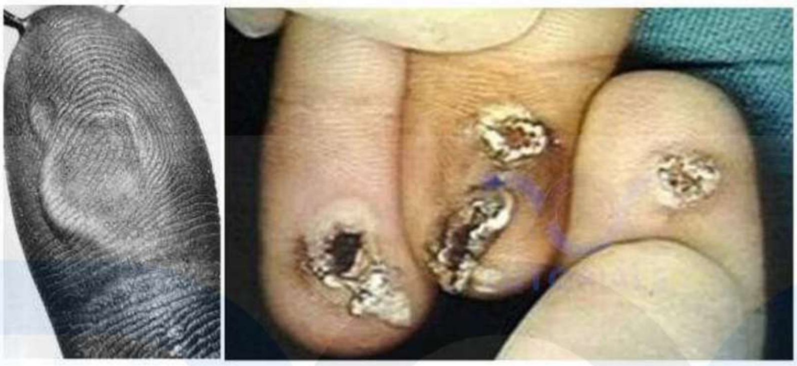


Fig: 26

- AC is more dangerous than DC.
- The most resistant body tissue to electrical injury is dry skin.

Cause of death

- If the current passes through
  - Head (Rare) → Medullary paralysis
  - Heart (MC) → Ventricular fibrillation (Mc cause of death)
- Over all dangerous path → Through head
- Most dangerous path to affect the heart is right hand to feet.
- Right hand to feet > left hand to right foot.
- Percentage of current passing through heart

a. Right hand to feet → 8.5%

b. Head to feet → 5.9%

c. Left hand feet → 5.1%

d. Hand to hand → 4.4%

Histology 01:03:40

1.Epidermis

- Elongation of cells with streaming of nuclei (Palisading appearance).
- Vacuolation

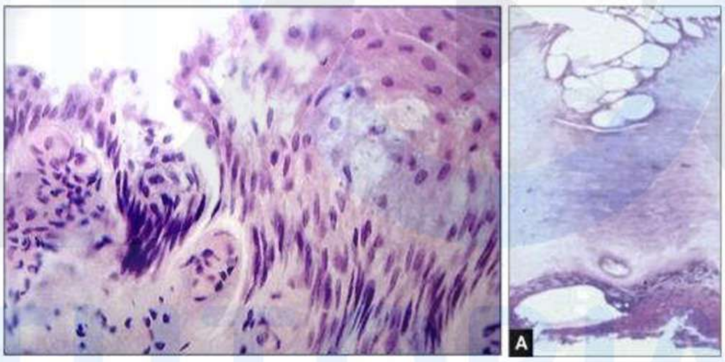


Fig: 27

2.Skeletal muscle:

- Zenker's degeneration → Hyalinized degeneration of skeletal muscle

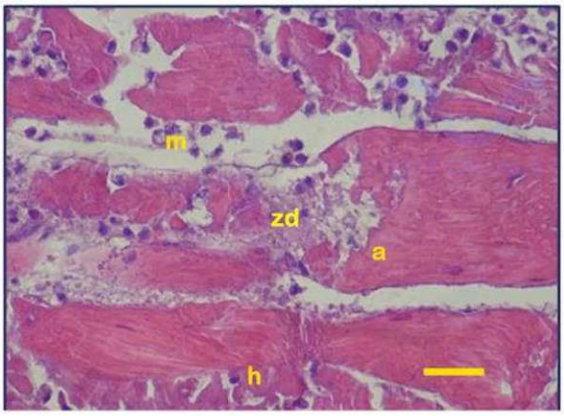


Fig: 28

3.**Bones:**

- Zigzag microfractures and bone necrosis
- The most commonly fractured in electrocution in upper limb is coracoid process.
- Lower limb → Neck of femur

Flash (or) spark burns (Exogenous burns)

01:06:46

- Due to high voltage currents, when sparking occurs between conductor & victim.

  i. Crocodile skin

  – Current jumps & burns the keratin

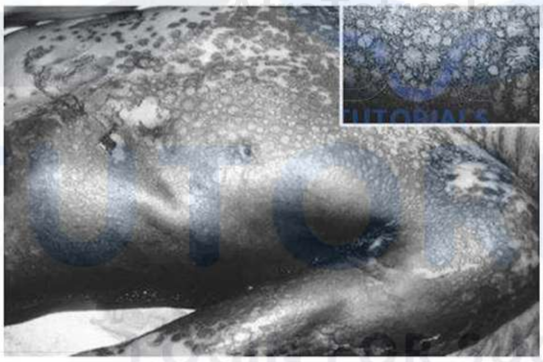


Fig: 29

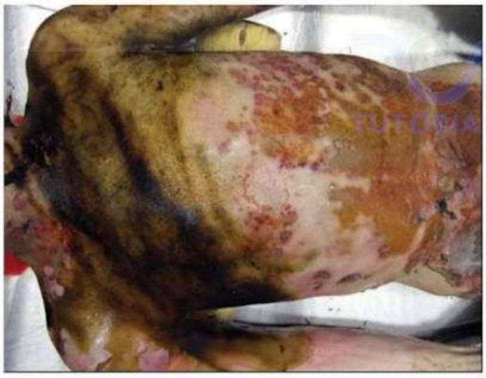


Fig: 30

ii. Arc eye

- Photo keratitis due to heat and UV lights by electric arc.

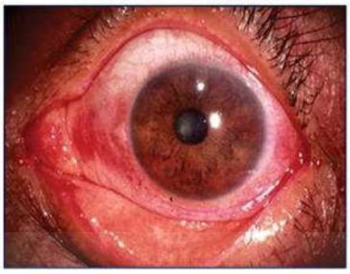


Fig: 31

- Acro reaction test
  - Micro-chemical test to detect causative electrode at the site of entry
- Current pearl → Small molten meat balls carried deep into the tissues
- Bone pearls & wax drappings
  - Melted $CaPo_4$, seen as round density foci on X-ray.

WOUND OF EXIT

- The appearance of exit wounds/marks are variable
- Often seen as splits and the edges are raised

Lightening 01:11:30

(kerauno = Thunder bolt / lightening)

Keraunoparalysis → Transient weakness in limbs following lightning strike.

I. Endogenous burns

1.Linear burns

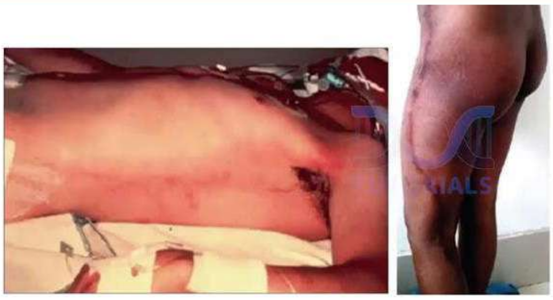


Fig: 32

- Seen in moist creases & folds of skin.
- Varies –30 cm in length & 0.3–2.5 cm in width.

2.Punctate burns

- Multiple circular burns: few mm to 1 cm .

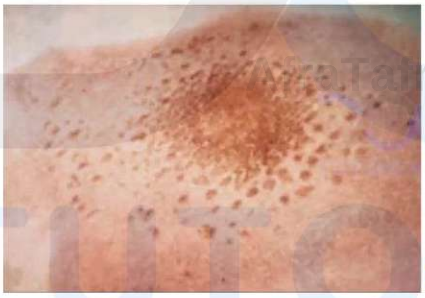


Fig: 33

3.Filigree burns

(Sync Lichtenberg/ arborescent marks, feathering, ferning, keraunographic burns).

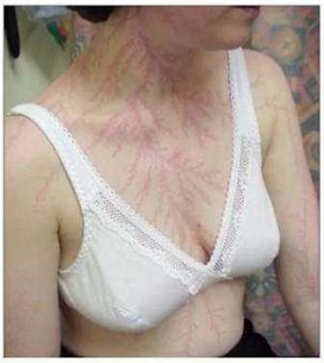


Fig: 34

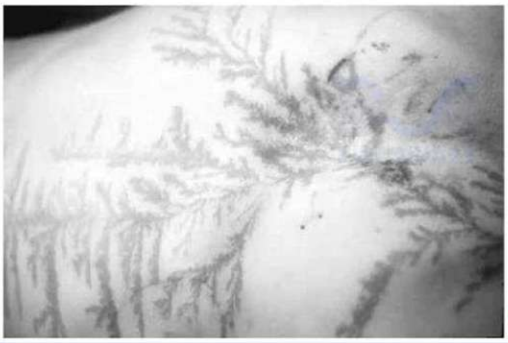


Fig: 35

- Most common site is shoulder, front of chest, flanks.

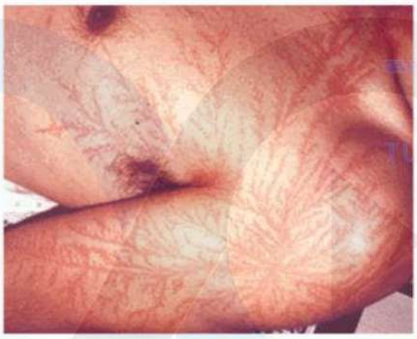


Fig: 36

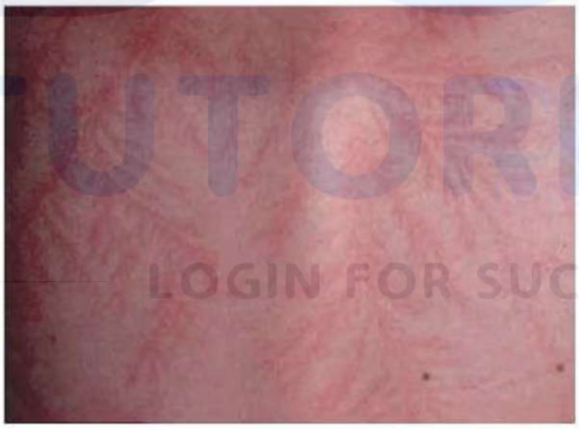


Fig: 37

- It is seen in 20-33% of cases.
- It does not follow vascular channels; it is due to lysis of RBCs along the path of electric current.
- It disappears in about 1-2 days.
- It is pink to brownish in colour.

II. Exogenous burns

- Surface burns → caused by external heat
- There may be melting and / or magnetization of metallic objects.

Factors that result in injury in a lightening flash (According to Spencer)

1.Direct effect of high voltage current.

2.Burning by super-heated air.

3.Effect of expanded & repelled air.

4.Sledgehammer effect

- Blow dealt by compressed air pushed before the current.

(Bruising is usually seen at the back of the head)

Extra Edge topics 01:20:51

HEAT RELATED EVENTS

<35°c	Hypothermic
32°c	Shivering stops
<30°c	Hypothalamus loses thermoregulatory ability
5-8°c	Fatal hypothermia
<-2.5°c	Frost bite (Skin becomes hard and black in 2weeks)
44°c	Minimum temperature required for producing burn (44°C for 4-5hours)
60°c	Minimum temperature required to produce scald
75°c	Minimum temperature required to produce pugilistic attitude

- Hemoglobinuria occurs when body surface burn percentage exceeds 30
- Haemorrhagic erosions and infarction in the small bowel and Haemorrhagic pancreatitis with fat necrosis on autopsy is seen in deaths due to hypothermia
- **Heat cramps** (Miner's/Stoker's/Fireman's cramps)
  - is profuse sweating with depletion of salt & water
  - No increase in body temperature
- **Heat syncope** (Heat prostration/heat exhaustion/heat collapse)
  - Death is due to peripheral vascular collapse
- **Heat hyperpyrexia/Heat stroke** (Direct exposure to sun → Sun stroke, Thermic fever)
  - Death is due to failure of cutaneous blood flow
  - Edema and *reduction of Purkinje's cells in cerebellum* are the most important finding in autopsy

INJURIES due to COLD

1.Frostbite (Frostnip is a mild form of frostbite)

- Occurs after exposure to extreme cold temperature (less than -2.5°C)
- In addition to extremities, it affects the face → nose, ears, chin and cheeks

- The tissue turns black and hard as it dies in about 2 weeks

2.Trench foot/immersion foot

- As the result of prolonged exposure to severe cold (5° to 8°C) & dampness
- There may be necrosis of fingers, toes or hand and feet
- Obliterating angitis causes severe gangrene and loss of tissue

3.Chilblains/pernio/perniosis

- Painful inflammation of small blood vessels in the skin
- Occurs in response to repeated exposure to cold but not freezing air

MEDICO LEGAL ASPECTS OF INJURIES

Sec 44 IPC 00:00:18

- It defines injury.
- The word 'Injury' denotes any harm whatever illegally caused to any person in body, mind, reputation or property.

Sec 319 IPC 00:02:00

- It defines hurt.
- Whoever causes bodily pain, disease or infirmity to any person is said to cause hurt.

Section 320 IPC → 00:04:38

i. Emasculation

ii. Permanent privation of sight of either eye (privation = loss)

  - Privation may be partial or complete.

iii. Permanent privation of the hearing of either ear.

iv. Privation of any member or joint.

  - Member = any part/organ of the body, which has its own function.

v. Destruction or permanent impairing of the powers of any member or joint.

vi. Permanent disfiguration of head or face.

(Scar of head/face can be considered)

vii. Fracture or dislocation of a bone or tooth

viii. Any hurt

- Which endangers life or
- Which causes the sufferer to be during the space of 20 days in severe bodily pain, or
- Unable to follow his ordinary pursuits
  (Mere hospitalization is not grievous hurt)

- Nature of injury irrespective of medical intervention.

Medico-legal nature of injury 00:17:30

1. Necessarily fatal
   - Person must die
2. Sufficient in ordinary course of nature to cause death
   - Survival is surprising
3. Likely to cause death
   - Death is surprising.

Indian Penal Code (IPC)

299	Definition of Culpable homicide (CH) [Culpable = Punishable]
300	Definition of Murder and CH not amounting to Murder
302	Punishment for murder
304	Punishment for CH not amounting to murder
307	Attempt to murder

308	Attempt to commit CH (not amounting to murder)
324	Voluntarily causing hurt by dangerous weapons
326	Voluntarily causing grievous hurt by dangerous weapons
334	Voluntarily causing hurt on provocation (Up to 1 M imp./Up to Rs. 500 Fine/Both)
335	Voluntarily causing grievous hurt on provocation (Up to 4Y Imp./Up to 2000 Rs. Fine/Both)

Homicide 00:26:47

i. Justifiable Homicide
   a. Judicial execution
   b. Military war
ii. Excusable homicide
   - Accidental death → during sports/games
iii. Culpable homicide
   i. Amounting to Murder (Murder)
   ii. Not amounting to murder

Intention	Act	Death	Offence
+	Is such as to cause death (gravity of injury is severe)	Happens	302

+	Is such as to cause death (Gravity of injury is severe)	No death	307
+	Usually, won't cause death (Gravity of injury is not severe)	Happens	304
+	Usually, won't cause death (Gravity of injury is not severe)	No	308

Dangerous Weapons 00:36:31

- It is defined under 324 & 326 IPC.
- Any instrument used

  i. For cutting, shooting, or stabbing.

  ii. As a weapon of offence is likely to cause death.

Dangerous Injury 00:38:27

- Any injury which poses immediate danger to life.
- An area of negative and positive vital reaction is seen in antemortem wound.

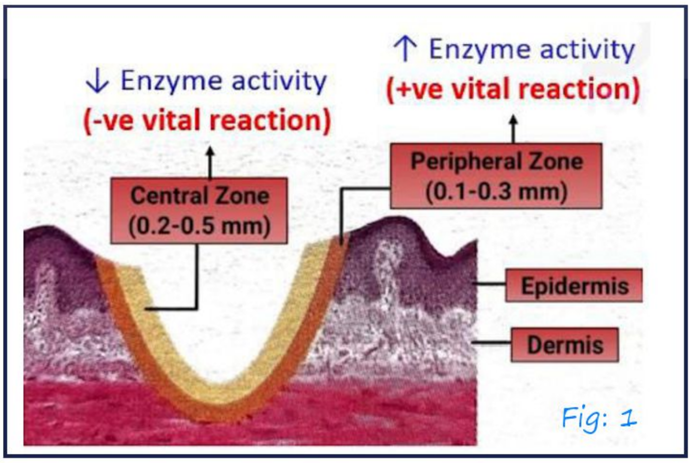

↓ Enzyme activity
(-ve vital reaction)
↑ Enzyme activity
(+ve vital reaction)
Central Zone
(0.2-0.5 mm)
Peripheral Zone
(0.1-0.3 mm)
Epidermis
Dermis

Fig: 1

- Immediately adjacent to the wound (Central zone - 0.2 to 0.5mm) there is ↓ Enzyme activity – known as negative vital reaction and next to the central zone is the peripheral zone (0.1 to 0.3mm), known as positive vital reaction.
- The enzyme/biochemical markers to be released at the site of wound.

• Tissue cathepsin	→	5-10 min
• Serotonin	→	10 min
• Histamine	→	20-30 min
• Esterase & ATPase	→	Within 1 hr
• Aminopeptidase	→	2 hrs
• Acid phosphatase	→	4 hrs
• Alkaline phosphate	→	6 hrs

- Ewing's postulate concerns with growth at the site following trauma.
- 39CrPC → All homicidal cases should be informed to police.

MECHANICAL ASPHYXIA PART - I

Asphyxia 00:00:35

- Asphyxia literally means pulselessness but in Forensic medicine, asphyxia means any conditions where there is interference with respiration due to any cause.
- Many of the victims of mechanical asphyxia showed high level of plasma thyroglobulin

Classical signs of asphyxia 00:02:13

i. Cyanosis → due to diminished O_2 tension.

ii. Petechial hemorrhages → due to increased venous pressure

iii. Congestion and edema → due to increased capillary permeability

(As a result of stasis and hypoxia)

Cyanosis 00:04:03

- Bluish discoloration of skin/mucous membrane.
- Minimum amount of reduced Hb required → 5g%
- More pronounced in lips, tip of the nose and tongue, nail beds, ear lobes etc.
- Not be evident in marked anemia.

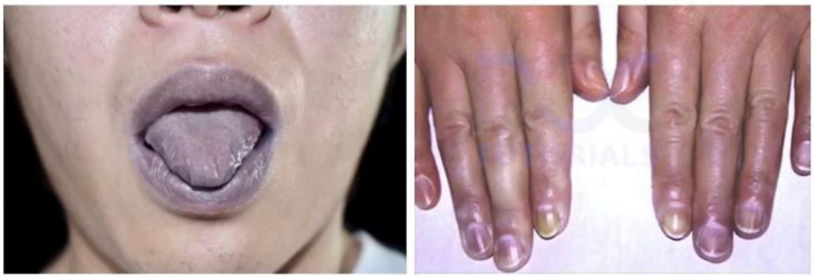


Fig: 1

Petechial hemorrhages 00:05:21

- Small pin-point collections of blood.
- Vary in size from 0.1mm to about 2mm.
- If larger than 2mm → ecchymosis
- It is due to the rupture of venules.
- Tardieu spots → petechiae lying in the visceral pleura
- Not a definite sign of asphyxia.

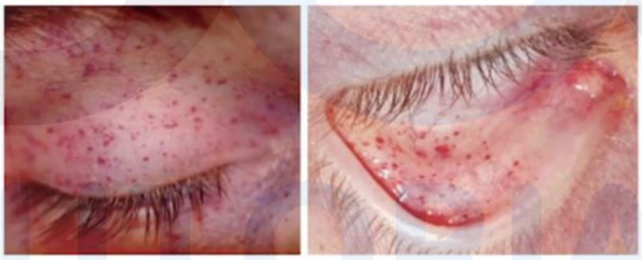


Fig: 2

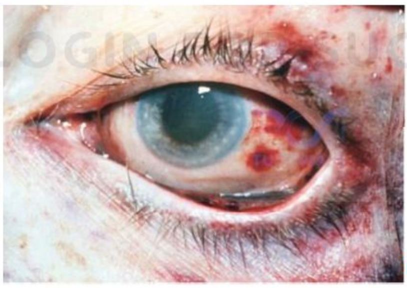


Fig: 3

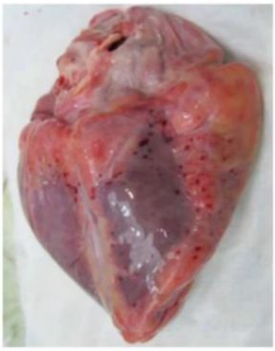


Fig: 4

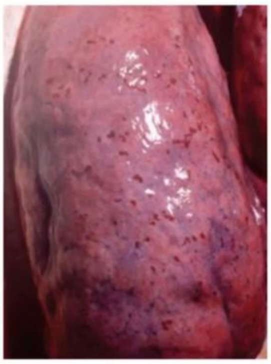


Fig: 5

- Usually seen above the level of constriction.

Classification 00:09:27

1.**Hanging**: Constriction around the neck, the constricting force is the weight of the body.

2.**Strangulation**: Constriction around the neck, the constricting force is other than the weight of the body.

3.**Suffocation**: It is an asphyxial death, other than constriction around the neck and drowning.

4.**Drowning**: Aspiration of fluid into the lungs.

I. Hanging 00:09:55

- Suspension of the body by a constriction around the neck, the constricting force is weight of the body.

Classification of hanging 00:11:37

1.According to the position of knot:

- Typical hanging → knot is at occiput

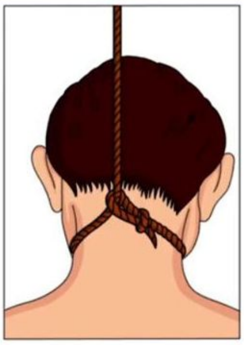


Fig: 6

- Atypical hanging → knot is at any other position

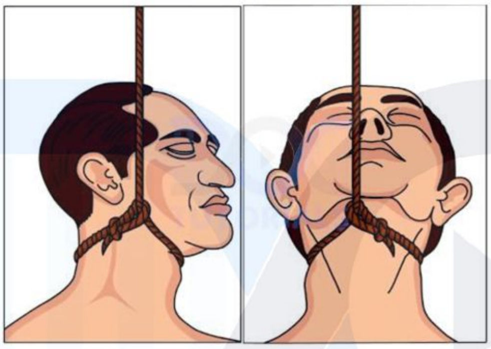


Fig: 7

2.According to the position of feet:

- Complete hanging → Feet/other parts of body do not touch the ground

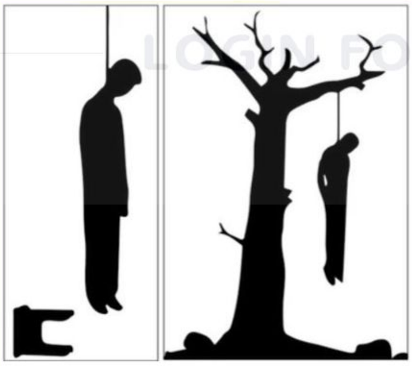


Fig: 8

- Incomplete/partial hanging → Feet/other parts of the touch the ground.

Fig: 9

3.According to the manner of hanging:

- Suicidal
- Homicidal
- Accidental
- Judicial

Constricting force required to obstruct some structures in the neck and their causative effect

00:14:06

Structure	Constricting force required to obstruct	Causative effect
Jugular vein	2kg	Cerebral apoplexy (Cerebral congestion)
Carotid artery	5kg	Cerebral anoxia
Trachea	15 kg	asphyxia
Vertebral artery	30kg	Cerebral anemia

- Apoplexy is the term used for cerebral congestion

Causes of death in hanging 00:16:42

1. Asphyxia (Fatal hypoxia → when O2 levels falls <20% of normal)
2. Venous congestion
3. Combined asphyxia and venous congestion → Most common
4. Cerebral ischemia
5. Reflex vagal inhibition
6. Fracture or dislocation of cervical vertebrae.

Ligature mark 00:18:43

- Usually oblique
- Usually does not completely encircle the neck.
- In ≈ 80% of cases, above the level of thyroid cartilage.

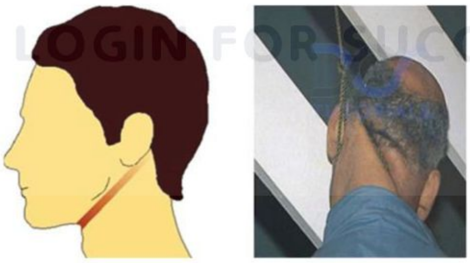


Fig: 10

Knot in hanging 00:24:32

i. Slip knot/running noose

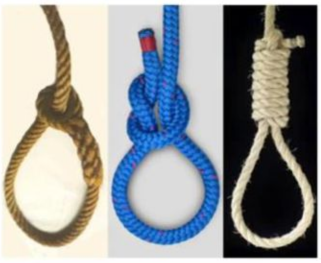


Fig: 11

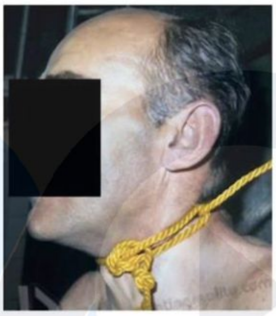


Fig: 12

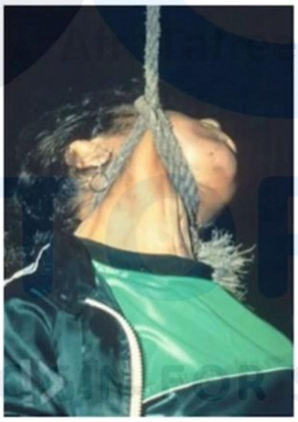


Fig: 13

- In slip knot ligature mark may be horizontal and encircle the neck completely (continuous) with knot mark

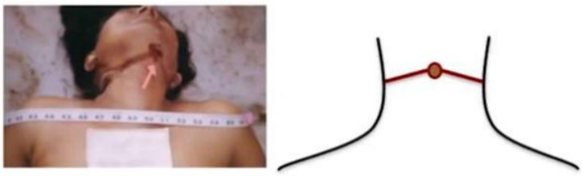


Fig: 14

ii. Fixed knot

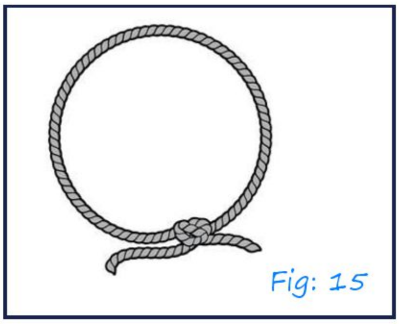


Fig: 15

Fig: 16

- Ligature mark is oblique and does not encircle the neck completely (Not continuous)

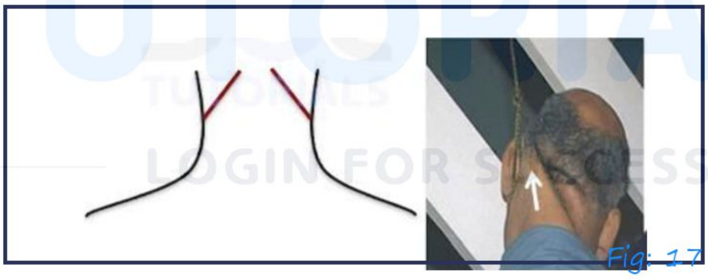


Fig: 17

Ligature mark 00:24:32

- Initially → looks pale
- Later → becomes yellow, then brown/dark brown and hard like parchment due to drying.

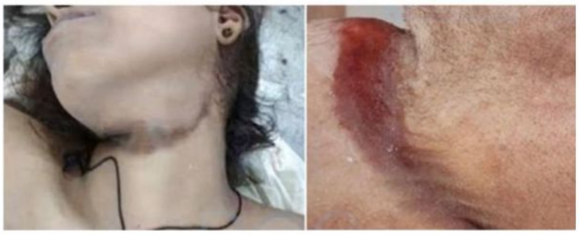


Fig: 18

Definite signs of A.M. Hanging 00:25:45

i. Dribbling of saliva

- It is due to stimulation of pterygopalatine ganglion/salivary glands.

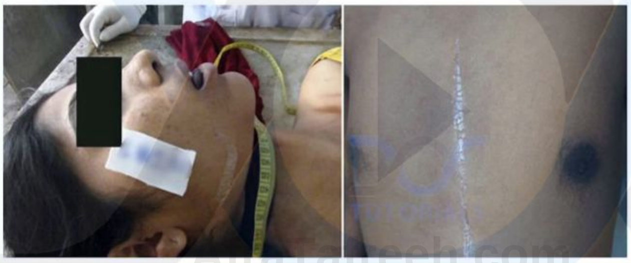


Fig: 19

i. Ammusat's sign

- Tear in the intima of carotid with ecchymoses.

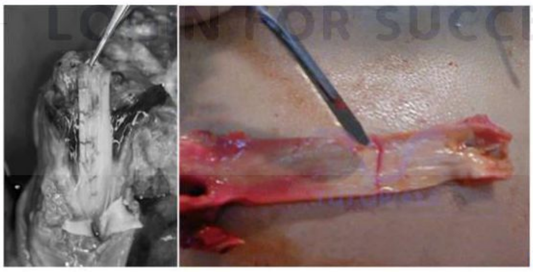


Fig: 20

- In hanging maximum stretching is seen over same side of knot which stretches the carotid artery leading to intimal tear in 5-10% of cases.
- It is usually associated with hanging with a drop.

ii. La facies sympathique

- It is a myth.
- In hanging, the maximum pressure is over opposite side of knot (Bight area), and if the ligature passes over cervical sympathetic, eye may be opened and pupil is dilated (this is on opposite side of knot) leading to La facies sympathique.

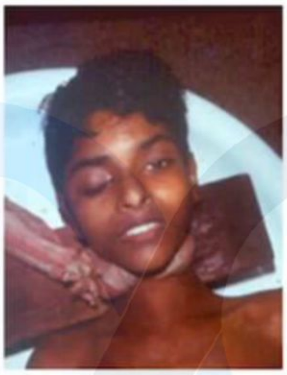


Fig: 21

- Glove and stocking pattern of P.M. Lividity in vertically suspended bodies; Example: hanging

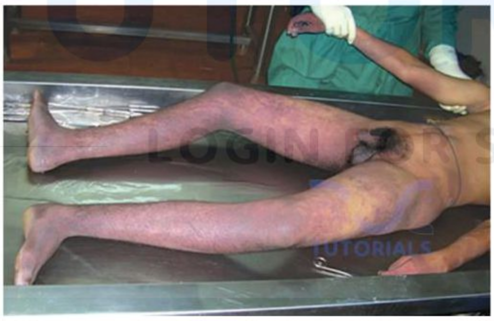


Fig: 22

- In case of complete hanging suspended for more than 8 hours, hypostasis is seen over lower aspects of limbs.
- In a person, if
  - Heart stops → respiration stops within 20 seconds, hence lung

become light (300mg)
  - Respiration stops → heart stops within 20 minutes, hence the lung becomes heavy (450 – 500mg)

- In testis → there is rigor in the dartos muscle causing compression of testis and epididymis which causes the contraction of seminal vesicle and prostate which gives rise to P.M. extrusion of semen.
  - Seminal stains may be seen in death due to any causes.
  - Most common in suspended bodies (Example: hanging).

Cheese–cutter method 00:41:48

- A narrow wire is used for hanging or strangulation.

Simon's hemorrhages/Simon sign/Simon bleeding 00:42:22

- It is seen beneath anterior longitudinal ligament of intervertebral discs in lower thoracic and lumbar vertebrae.
- Due to over stretching of spine because of free suspension of the body (Example: hanging).
- Also seen in
  - Vehicular accidents
  - Fall from height
  - Drowning

- Hypothermia

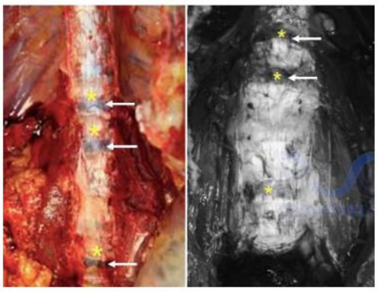


Fig: 23

- Hanging knot is removed by cutting the ligature away from the knot.
- The cut ends should be tied by a thread to prevent fraying
- If coir rope is used, the fibers on skin is lifted by using cello tape.

Knot in judicial hanging 00:47:09

- Officially used → Left sub-aural (angle of mandible) position.
- Most effective position → Submental (Below the chin) Disadvantage: may slip

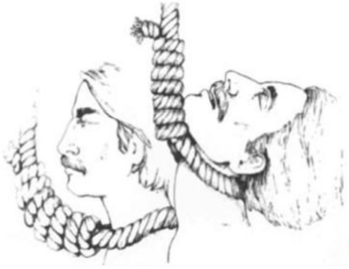


Fig: 24

- Hangman's fracture
  - It is fracture of C2 (C2/C3)

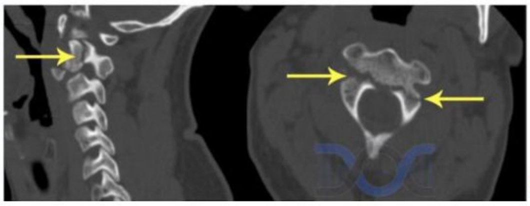


Fig: 25

- Death in judicial hanging is because of fracture of upper cervical vertebrae.

- Jefferson's fracture
  - It is fracture of C1
- Undertaker's fracture
  - It is fracture of C6 – C7
- Lynching
  - It means public hanging (in FMT)
  - Mob. Killing → Homicidal

Fig: 26

- Suicide pact
  - An agreed plan between two or more individuals to commit suicide.

Fig: 27

- Dyadic death
  - It is homicide followed by suicide.

Fig: 28

- Complicated suicide
  - During the original method of suicide, unintentional trauma occurs which leads to death.
- Complex suicide
  - More than one method is used to commit suicide.

Strangulation 00:56:47

- Constriction around the neck, the constricting force is other than weight of the body.

  1.Ligature strangulation
  - By a ligature
  - Can use a nylon rope, shawl, cloth, belt etc.
  - Ligature mark
    - Usually transverse (rarely oblique) and completely encircle the neck
    - Usually below the level of thyroid cartilage

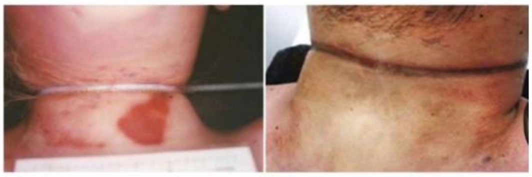


Fig: 29

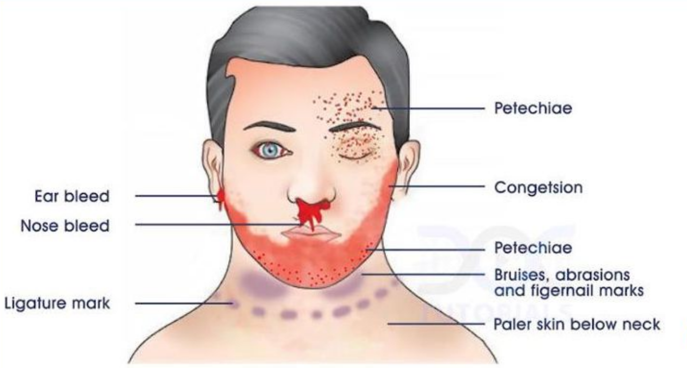

Petechiae
Ear bleed
Congetsion
Nose bleed
Petechiae
Bruises, abrasions and figernail marks
Ligature mark
Paler skin below neck

Fig: 30

- Pseudo strangulation
  - Skin folds in neck may mimic ligature mark in dead person or infant.

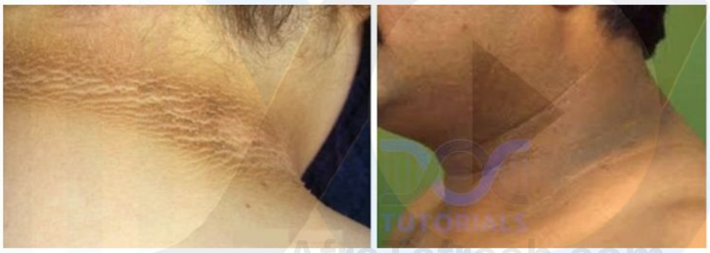


Fig: 31

2.Manual strangulation

- By hand/hands
- In throttling
  - In skin you get six penny bruises.
  - Six penny bruises are multiple small bruises caused by finger tips and finger pulp.

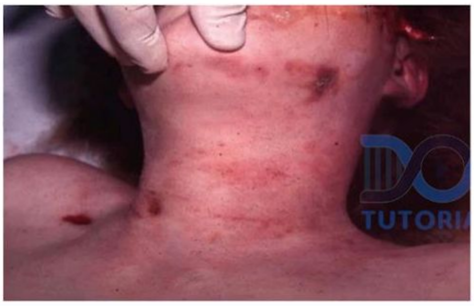


Fig: 32

- Six penny bruises are also seen in shaken baby syndrome.
- Subcutaneous tissues in neck → ecchymosis
- Neck muscles → extensive bruising

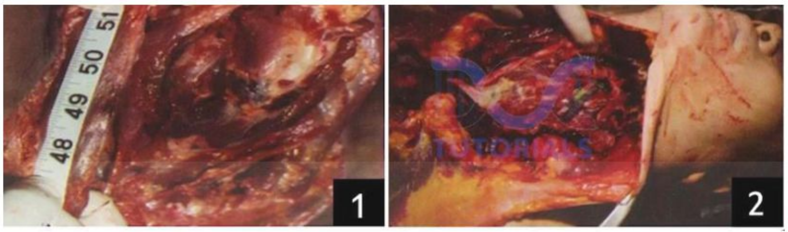


Fig: 33

- Carotid artery → Intimal tear in 10-15% of cases.
- Hyoid bone → Fractures in 30 – 50% of cases
- Thyroid cartilage: fracture of superior horn (Common)
- Cricoid cartilage → May show fracture
- Tracheal rings → May show fracture
- Mucosal hemorrhages → in the interior of larynx immediately below the vocal cords.

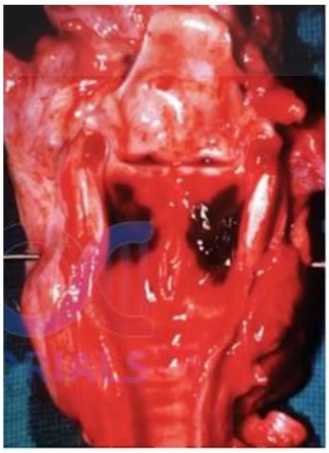


Fig: 34

3.Palmar strangulation

- One hand is placed over mouth and nostrils and the neck is constricted by base of other hand.

Fig: 35

4.Mugging (Arm lock, choke hold)

- By bend of the elbow/knee
- The pressure exerted on
  - Front of larynx → Air choke (Bar arm control)

Fig: 36

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  - Both sides of neck → Blood choke (Carotid sleeper hold)

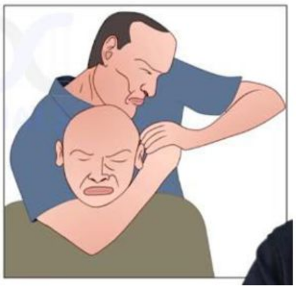


Fig: 37

5.Bansdola

(It means doing away with bamboos)

- Compression of the neck by bamboos / sticks /rods.

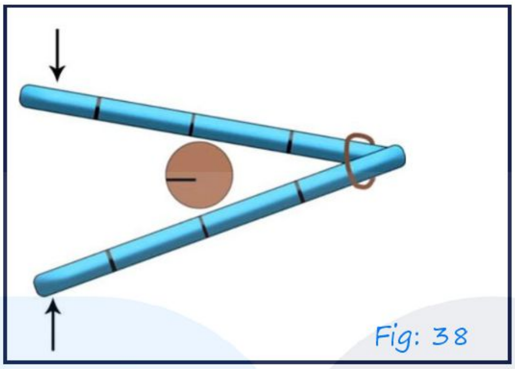


Fig: 38

6.Garroting

- In this, the victim is strangled from behind without warning.

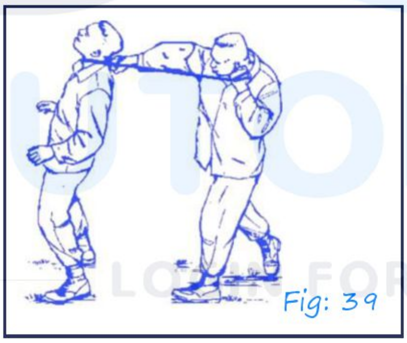


Fig: 39

Spanish windlass technique 01:12:05

- It was a method of judicial execution in Spain and Turkey.
- A mental collar around the neck was tightened by a lever from behind.
- It's a method of garroting (Although not as per definition).

Fig: 40

Fracture of hyoid bone in asphyxia death

01:13:20

There are 2 types

i. Antero-posterior/outward compression fracture or abduction fracture.

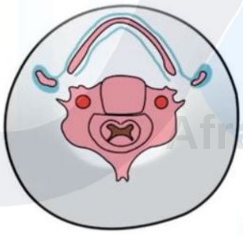


Fig: 41

- Seen in hanging (15-20%)

ii. Inward compression fracture or adduction fracture.

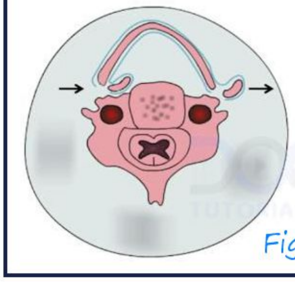


Fig: 42

- Seen in throttling (30-50%) - most common

- Rarely, if the knot is on the side, then the hyoid bone may get pressed obliquely.

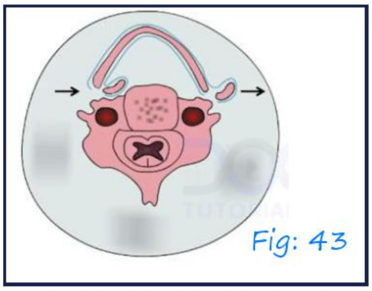


Fig: 43

- In antemortem fracture → Ecchymosis under the periosteum & hemorrhagic spots at fracture site.

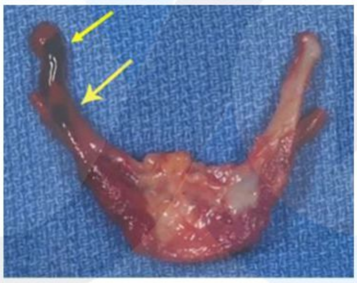


Fig: 44

- Hyoid bone usually fractures at the junction of inner 2/3rd and outer 1/3rd of greater cornu.
- Hyoid bone usually fractures after 40 years of age (due to calcification).
- Hyoid bone fracture is rare in ligature strangulation.

Avulsion fracture (Traction/Tug fracture) of hyoid bone

- It is an indirect type of fracture, caused by muscular overactivity.
- Due to traction force through thyroid membrane.

MECHANICAL ASPHYXIA PART - II

III. Suffocation 00:00:32

- It is an asphyxial death, caused other than that by constriction around the neck & drowning.
- Suffocation deaths are true asphyxial deaths.

I. Smothering

- Mechanical occlusion of external air passage (both external respiratory orifices).
- Bruising in the inner aspect of the lips is suggestive of smothering.

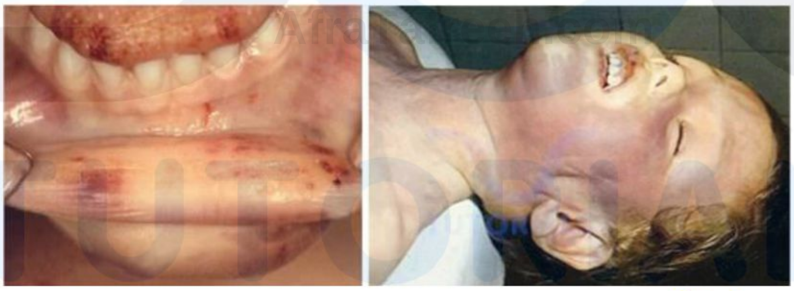


Fig: 1

- Bruising can also take place on an attempt to prevent shouting.

II. Gagging

- A cloth/paper/plastic is stuffed deep into the mouth to touch the post pharyngeal wall.

III. Choking

- It is occlusion of internal air passage.
- Usually by a solid object but may be by blood.
- Intubation injury may resemble choking.

Cafe Coronary 00:06:49

- The term was coined by Roger Haugen.
- Sudden & unexpected death of a healthy person during a meal.
- No signs of respiratory distress or any classical signs of asphyxia.
- Intoxication causes inhibition of gag reflex & bolus of food in larynx/pharynx stimulates vagal (vagal stimulation) and the person dies of cardiac arrest. (There are signs of asphyxia in choking)

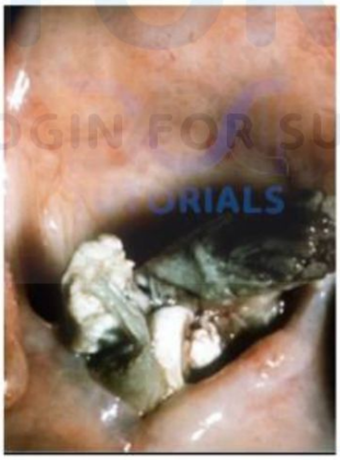


Fig: 2

IV. Traumatic Asphyxia

- Air entry inhibited by mechanical fixation of chest, preventing respiration movements.

- There is trauma to the chest.
- Cardinal external signs

  i. Multiple petechial hemorrhages.

  ii. Cyanosis

  iii. Line of demarcation

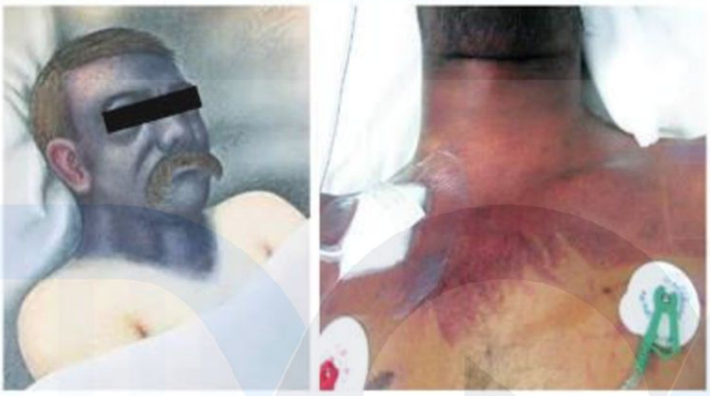


Fig: 3

V.Postural/Positional asphyxia

- Exclusion of air from lungs due to abnormal position of the body.

  (No trauma to the chest).

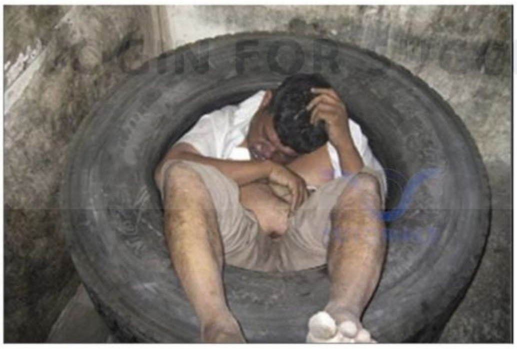


Fig: 4

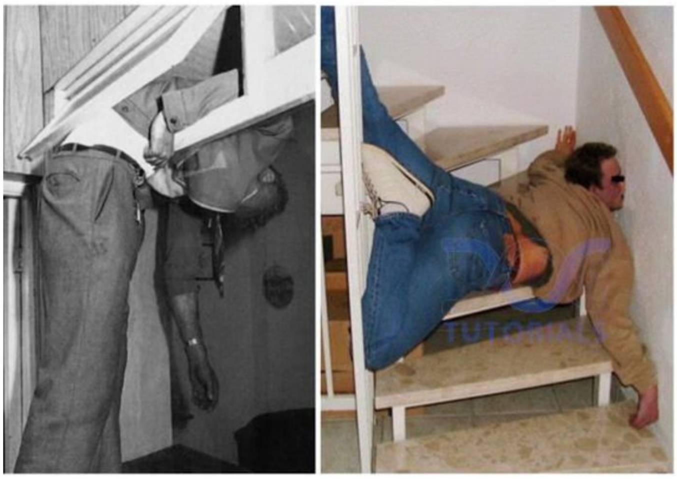


Fig: 5

- Jack knife position (JKP) → Knee – chest position.
  - Prolonged JKP may compromise the process of respiration and cause death by positional asphyxia.

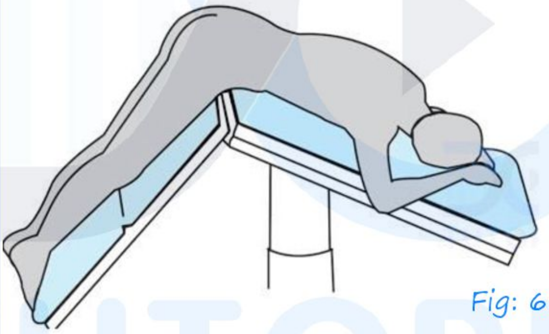


Fig: 6

Fig: 7

- JKP can also cause death by traumatic asphyxia

VI. Burking

- It is a combination of smothering and Traumatic asphyxia.

VII. Overlaying/Overlying

- Death may be due to smothering or traumatic asphyxia.

VIII. Environmental suffocation

- Due to lack of O_2 in the atmosphere.

Autoerotic Asphyxia 00:27:33

- Hypoxia is a sexual stimulant.
- But there is a thin line between hypoxia required for sexual stimulation & hypoxia required for unconsciousness and then he might die due to sexual asphyxia.
- Also known as kotzwarraism/Hypoxiphilia.
- Most common method adopted is Hanging (autoerotic hanging)

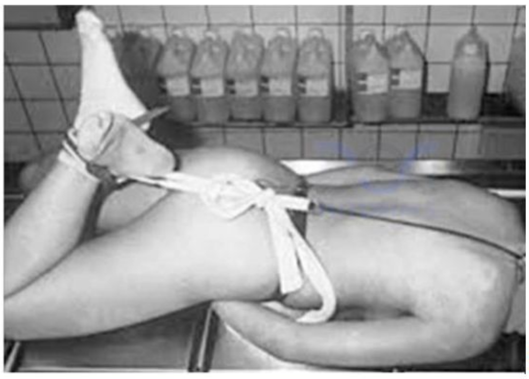


Fig: 8

- It is associated with masochism and may be transvestism & voyeurism.

Drowning 00:31:47

- Aspiration of fluid into the lungs by complete/partial submersion in water or other fluids.
- Global mortality of drowning is 6.8 per lakh and > 50% is seen within 15 years of age
- 1 – 4 age groups is the highest rate of drowning observed worldwide

Classification 00:33:04

I. Wet drowning (Classical/Typical primary drowning)

Water is inhaled into lungs

↓

Churned up with mucous (d/t violent respiratory efforts)

↓

Copious amount of white, fine, leathery froth with pulmonary edema

↓

Emphysema acquosum (drowning lung)

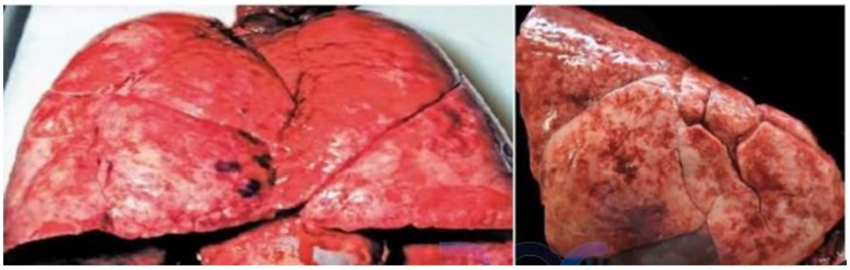


Fig: 9

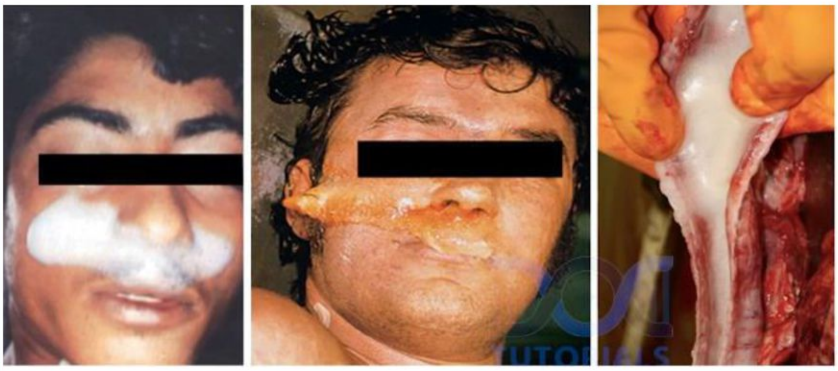


Fig: 10

Causes of death in wet drowning

- When water enters lungs, person may die of disruption of pulmonary surfactant.
- There are 2 types of drowning

  i. Fresh water drowning:

  Water from lungs enters blood (due to osmosis) → Hemodilution→ Hemolysis → Release of K^+ → Hyperkalemia → Ventricular fibrillation → Death in about 4-5 minutes

  ii. Salt water drowning:

  Water from blood enters lungs (due to osmosis) → Hemoconcentration → Hypernatremia → Bradycardia → Cardiac arrest → Death in about 8-12 minutes

II. Submersion of an unconscious person

Water enters lungs

↓

Mixed up with mucous

(But decreased respiratory movement due to unconsciousness)

↓

Minimum froth with pulmonary edema
↓
Edema acquosum

III. Dry drowning (10-15%)

- Here, the water trickles the larynx & causes laryngospasm.
- Absolutely no froth.

IV. Immersion Syndrome

- Also known as hydrocution, submersion inhibition.
- As soon as the person
  - a. Falls on icy cold water
  - b. If cold water entering ear drums
  - c. Water striking the epigastrium

  ] Causes cardiac arrest due to vagal inhibition
- No froth
- Most common in children & intoxicated adults.

V.Secondary drowning (post immersion syndrome)

- Here, the person submersed in water is resuscitated but dies after 24hrs due to complications
- Most common complication → post hypoxic encephalopathy
- No froth
- Near drowning = The victim survives the drowning episode.

Hydrostatic lung 00:51:26

- If a dead body is kept in water (postmortem immersion) at a depth of 2 meters for >20 hours, water passes into lung due to hydrostatic pressure.
- Pulmonary edema takes place but no froth → Hydrostatic lung

Definite signs of antemortem drowning 00:53:38

1.Cadaveric spasm with weeds/grass in hand.

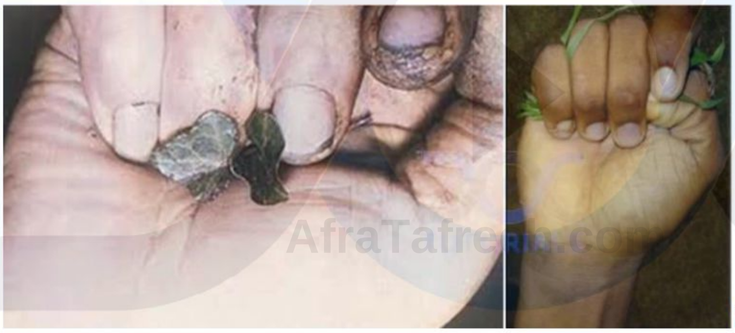
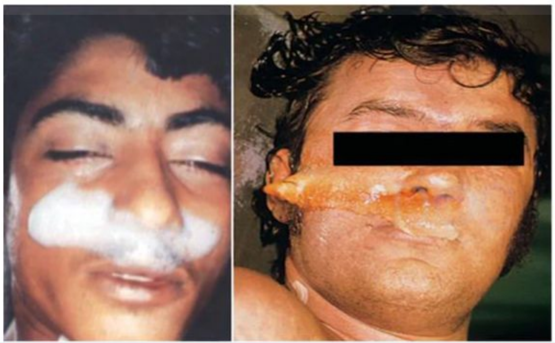


Fig: 11

2.Emphysema acquosum

3.Copious amount of white, fine, leathery froth (due to emphysema acquosum)



[redacted]

Fig: 12

4.Paltauff's hemorrhages

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- Due to rupture of alveoli
- Seen in subpleural space in about 50% of cases.
- Most common location → lower lobes
- Size → minute or up to 3-5cm in diameter

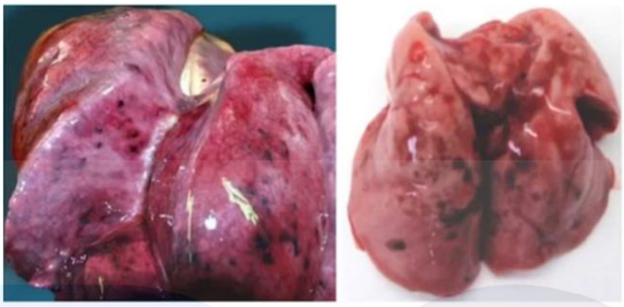

Fig: 13

Diatoms (?) 00:56:49

- It is microscopic, unicellular algae.
- Varies in shape & size (2micrometer to 1mm)

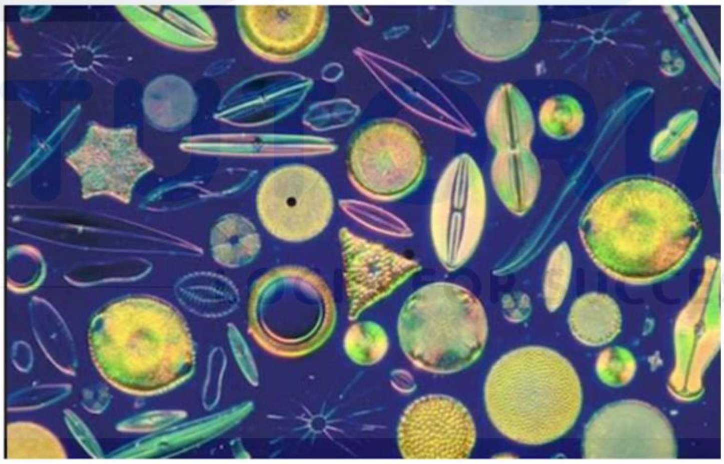

Fig: 14

- Max. size which can enter into pulmonary circulation → 40 micrometers.
- The outer salicaceous (silica) coat is known as → Frustule.
- Frustule is resistant to heat, acid & putrefaction.

- Examined by acid digestion technique.
- Best organ for diatom study → femur
- Most commonly used bone → sternum.
- Most preferred soft organ → Kidney
- Medicolegal importance of diatoms is controversial.
  - If the same species of diatoms present in the drowning media is present in bone marrow and if the victim had not drunk the same water before submersion is the most important internal sign of antemortem drowning.

Other findings in drowning (Not definite signs)

01:02:57

I. Cutis anserina (Goose skin/flesh/bump)

- Granular & puckered appearance of skin
- Due to spasm of arrector pili muscle due to cold.
- Especially seen over thighs.
- Also seen in case of rigor mortis of arrector pili muscles.

Fig: 15

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II. Reaction of phenomenon

- Retraction of scrotum & penis due to cold.

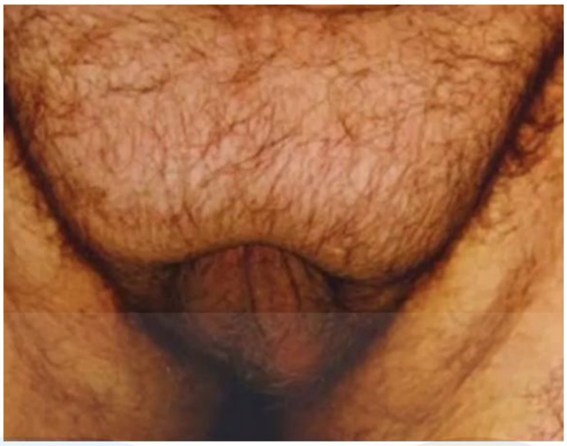
Fig: 16

III. Washer woman's hands & feet

- Due to absorption of water into outer layers of skin.
- Starts at fingerprints.
- Occurs early in warm water.
- Seen in about 24 hrs.
- It is only a sign of immersion

TUTORIALS LOGIC FOR SUCCESS

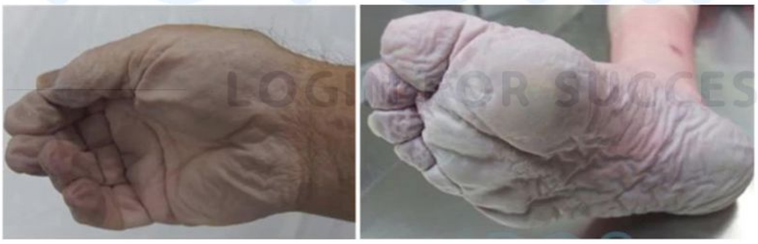
Fig: 17

- 2-4 hours: Wrinkling & soddening of fingertips
- 4-8 Hours: Bleaching of epidermis
- 24 hours: Entire hand shows bleached, wrinkled and soddened appearance (Washer woman's Hands/Feet)
- 48 hours: Peeling of cuticle from palm and sole
- 3-4 days: Skin can be peeled off like a glove

IV. Temporal bone hemorrhages

- Seen in about 50% of cases.
- Also seen in
  - i. Hanging
  - ii. Strangulation
  - iii. Head injury
  - iv. CO poisoning

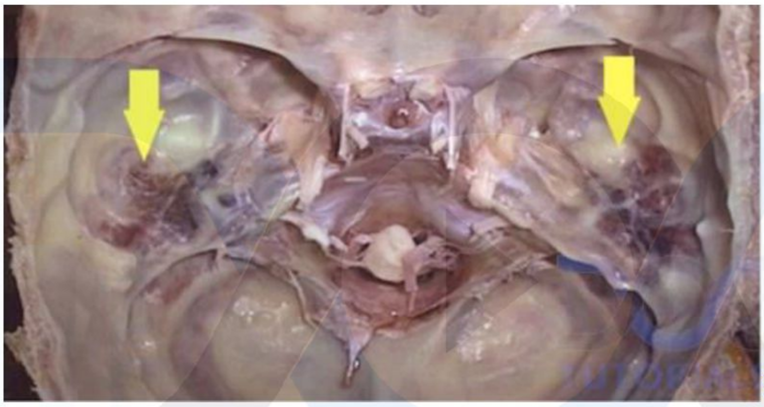

Fig: 18

V. Water in GIT

- Stomach → 70% cases
- Intestine → 20% cases
  - Hyperventilation before drowning causes flushing out of CO_2 → No hypercapnia to stimulate respiratory centre → Causes rapid death
  - Flotation is due to putrefactive gases.
  - Floatation of body in India.
    - a. Summer → 12-18 hours
    - b. Winter → 18-36 hours

Differentiation between fresh water & saltwater drowning can be done by estimation of

i. Bromide
ii. Magnesium
iii. Strontium
iv. Gettler's chloride test → measuring Cl^- content in chamber of heart (not reliable)

IMPOTENCE, STERILITY AND VIRGINTY

Sexual dysfunction 00:00:23

- It may be seen in both males and females.
- Males → it is known as impotency i.e. inability to perform sexual intercourse

  Most common cause is vasculogenic.
- Females → It is known as frigidity.
  - Frigidity is inability to initiate and maintain sexual arousal.
  - Most common cause is vaginismus.

TUTORIALS LOGIC FOR SUCCESS

Quoad Hank and Quoad Hunk 00:02:00

Quoad Hank

- It is a psychological impotency to a particular female.
- If a married man is quod to his wife, right from the time of marriage where sexual intercourse never took place, it will be a ground for nullity of marriage.

Quoad Hunk

- It is a psychological impotency to a particular male
- If a married woman is quod to her husband, right from the time of marriage where sexual intercourse

never took place, it will be a ground for nullity of marriage

Nullity of marriage 00:03:35

- It is annulment of marriage
- Grounds for annulment of marriage
  i. Non consummation of marriage → sexual intercourse has not been taken between wife and husband.
  ii. Impotency → right from marriage..
  iii. Mental illness → right from marriage
  iv. Incurable STD in a communicable form → right from marriage
  v. Intoxication at the time of marriage.
  vi. Both are of same sex
  vii. Marriage by force
  viii. Marriage by threat (fear of death, hurt, rape etc.)
  ix. Marriage by impersonation
  x. Marriage by fraud
  xi. Child marriage
  xii. Already married
  xiii. Pregnancy at the time of marriage

Divorce 00:09:28

- It is dissolution of marriage

  Grounds for divorce without mutual consent:

  1.Desertion

  2.Cruelty

  3.Unnatural sex

  4.Adultery

  5.Mental illness – subsequent to marriage

  6.Incurable STD in a communicable form → subsequent to marriage

  7. Change of religion after marriage without the consent of the partner.

  8. Renunciation of the world.

  9.Presumption of death: If the whereabouts of a person is not known for more than 7 years.

  10. When a girl is married before the age of 15 years, but rejects the marriage between 15-18 years.

Assisted Reproduction technique (A.R.T) 00:14:55

- Assisted reproductive technology means
  - all techniques that attempt to obtain a pregnancy by handling the sperm or the oocyte outside the human body and transferring the gamete or the embryo into the reproductive system of a woman

- Commissioning couple – Infertile married couple who approach an ART clinic/bank for obtaining the services
- ART services can be given to a man b/w 21-55 yrs and woman b/w 21-35 yrs.
- Written informed consent is a must
- No mixing of semen
- Age of the semen donor should be between 21-55 years.
- Maintain confidentiality

Oocyte donor

- Must be married
- Between 23 and 35 years of age
- Should have at least one live child of her own with a minimum age of 3 years
- Can donate oocytes only once in her life
- A bank should not supply the sperm or oocyte of a single donor
- To > 1 commissioning couple
- Donor should be healthy both physically and mentally

Legitimacy

- The child born through ART is deemed to be a
  - Biological child of the commissioning couple
- The child is entitled to

  - All the rights as a natural child of the commissioning couple
- A donor loses all parental rights over the child/children

Consent of both spouse

- For A.R.T – consent of both the spouse required
- For abortion and sterilization – not required (May be ground for divorce without consent)

Types of hymens 00:21:56

1.Semilunar → most common

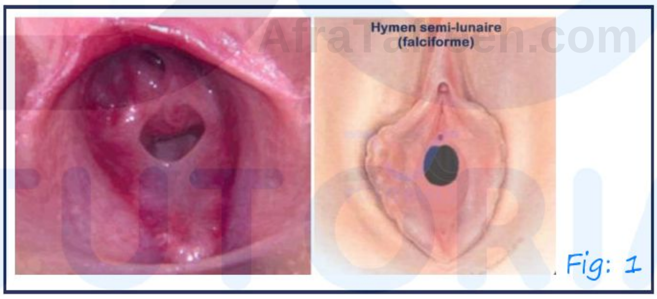

Fig: 1

2.Annular → second common

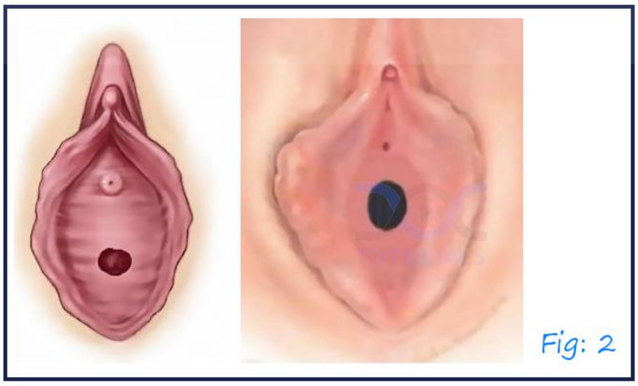

Fig: 2

3.Fimbriated

- Multiple notches; asymmetrical, but do not touch the vaginal wall
- Mimics torn hymen.

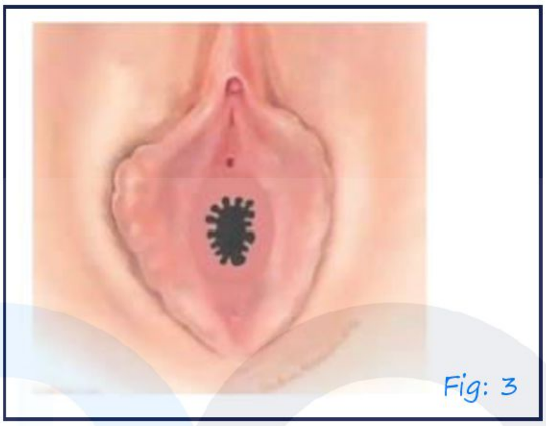

Fig: 3

4.Dentate → teeth like edges

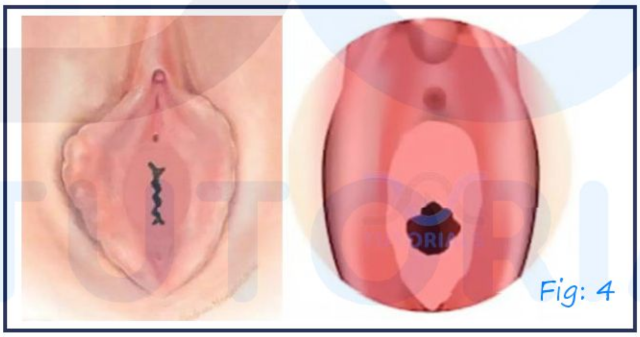

Fig: 4

5.Cribriform → multiple sieves (openings)

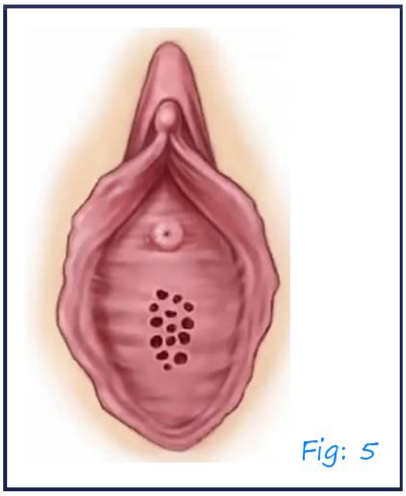

Fig: 5

6.Marginal → Thin rim of hymen → wide hymenal opening

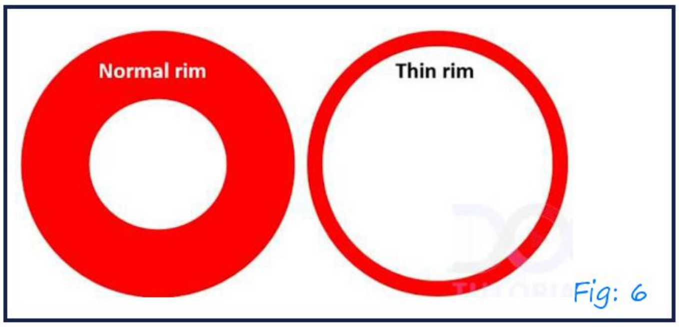
Normal rim
Thin rim

Fig: 6

7.Micro perforate → very small opening

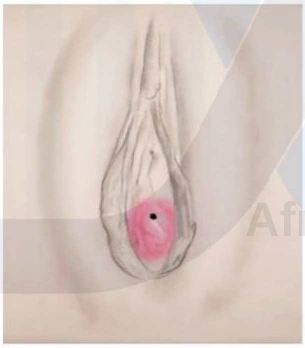

Fig: 7

8.Imperforate

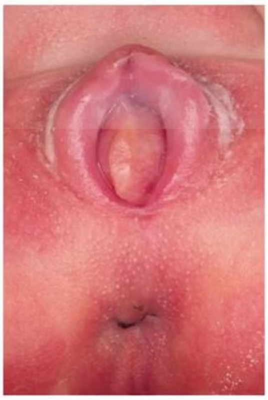

Fig: 8

9.Septate/Biseptate

Fig: 9

- Curunculae myrtiformis
  - Seen after vaginal delivery → tags of hymen
- Curunculae hymenalis
  - Seen in frequent sexual intercourse → tags of hymen

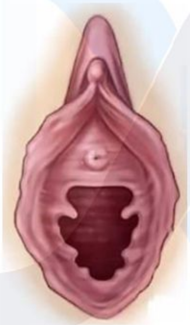
Fig: 10

- In case of sexual assault on a child, hymen often escapes injury because it is deeply seated.
- A female may be
  - Virgin → never had sexual intercourse.
  - Deflorate → lost her virginity.
  - False virgin → Deflorate but intact hymen, due to elastic hymen.

Rupture of hymen 00:30:07

- Hymen gets ruptured by
  - i. Sexual intercourse
    - a) Posterolateral (between 5 and 7 O' clock) – most common
    - b) Posterior (6 'o' clock)
  - ii. Digital penetration
    - a) Antero-lateral (between 11 and 1 O' clock) – most common
    - b) Anterior (12 'O' clock)
- The most important sign of defloration is dilatation of vaginal canal

Causes of rupture of hymen:

- Sexual intercourse
- Digital penetration
- Masturbation
- An accident
- Sola pith or sanitary tampons introduced into vagina
- Medical intervention
- Gynecological examination
- Surgical intervention
- Scratching
- Diphtherial ulcers etc.

Assisted Reproductive Technology (Regulation) Act, 2021

- Maximum 7 oocyte can be retrieved
- Not more than three oocytes or embryos may be placed in the uterus of a woman during the treatment cycle
- The collection of gametes posthumously can be done only if prior consent of the commissioning couple is available
- Sex selection and determination is prohibited
- Examine the donors for such diseases, as may be prescribed
- All unused oocytes shall be preserved by the banks for use on the same recipient, or given for research to an organization after seeking written consent from the commissioning couple
- All information about the donor should be recorded, including the name, identity & address
- Should undertake in writing about the confidentiality of such information
- All records should be maintained for at least a period of 10 years
  - Later send it to central database of the National Registry;

- The gamete of a donor or embryo can be stored for a period of not more than 10 years
- No commercialization

Penalties

1. Sex selective assisted reproductive technology
   - 5-10 years imprisonment or fine from 10 to 25 lakh rupees or with both
2. Other offences:
   - First contravention → Fine of 5 to 10 lakh rupees
   - Subsequent contravention → 3 to 8 years imprisonment
     → Fine of 10 to 20 lakh rupees

PREGNANCY, DELIVERY AND ABORTION

- Definite signs of pregnancy are
  a. Hearing the fetal heart sounds
  b. Palpating the fetal parts
  c. X-ray diagnosis
  d. Ultrasonography

hCG test:

- It is only probable sign of pregnancy
- Positive results are seen in
  - Chorionic epithelioma
  - Hydatidiform mole
  - About up to 1 week after delivery
- Foetal parts can be detected by X-ray usually by 16 weeks

Twin Pregnancy 00:01:17

i. Superfecundation:

- 2 ova released in same menstrual cycle get fertilized by coitus of 2 different people

Fig: 1

ii. Superfetation:

- Fertilization of 2 ova released at 2 different menstrual cycle (fetus over the fetus)

Fig: 2

Foetus papyraceus/Fetus compressus 00:03:33

- The foetus get flattened & mummified in a multiple gestation pregnancy

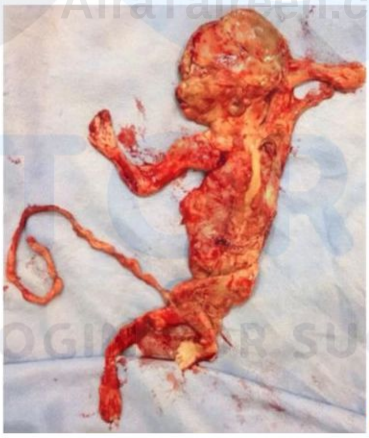

Fig: 3

Fecundation Ab Extra 00:04:14

- It is a rare condition
- Pregnancy caused by the deposition of semen over vulva or inner aspect of thigh

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Affiliation case 00:05:05

(Suits for adoption)

- A woman files a case in the court for fixing the paternity of her illegitimate child
- Affiliation cases are related to paternity dispute

Supposititious Child 00:06:43

- A fictitious child or forged child or substituted child
- A child never born to the woman claiming that it is belonging to her

Atavism 00:08:04

- Atavis = grandfather
- A child doesn't resemble to its parents but resembles its grandparents

Wrongful pregnancy 00:08:48

- It is the pregnancy caused by the fault of the doctor
- Could be due to

  a. A failed sterilization operation

  b. An unsuccessful MTP

  c. Ineffective prescription of contraceptives
- Shape of nulliparous cervical OS is circular
- Shape of parous cervical OS is transverse

Arbor vitae uteri 00:09:46

- A vertical fold on anterior & posterior cervical walls; with radiating oblique folds
- Disappears after delivery

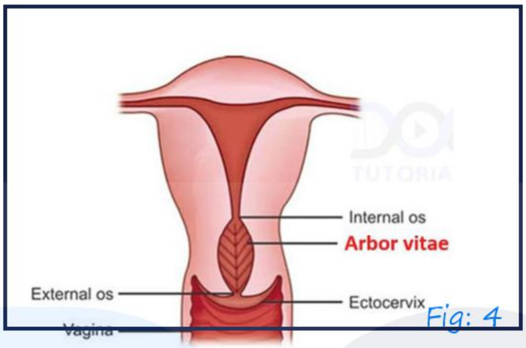

Fig: 4

Lochia 00:10:38

- It is the vaginal discharge seen after delivery
- Healing process of placental site

  i. Lochia rubra: First 4-5 days → Bright red

  ii. Lochia serosa: Next 4 days → serous

  iii. Lochia Alba: After 9-10 days → White or yellowish
- Disappears in about 3 weeks

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Posthumous Child 00:11:45

- A child born after the death of a biological parent
- Most instances of posthumous birth involve the birth of a child after the death of its father, but the term is also applied to infants delivered after the death of the mother, usually by caesarean section
- Medical termination of pregnancy (MTP) act was passed in the year 1971

Abortion/Miscarriage (312 – 316 IPC) 00:14:02

- **William's Obstetrics**: Abortion is defined as spontaneous or induced termination of pregnancy before fetal viability
- As per law → expulsion of products of conception at anytime before full term
  - i. Spontaneous abortion
    - a. Natural
    - b. Accidental
  - ii. Artificial
    - a. Justifiable → as per the provisions of MTP act
    - b. Criminal

Criminal abortion

- 312 IPC → with consent
- 313 IPC → Without consent
- 314 IPC → Death of mother
- 315 Act done with intent to prevent child being burn alive or to cause it to die after birth
- 316 causing death of quick unborn child by act amounting to culpable homicide
- Incidence of natural abortion is 10-15%

Medical Termination of Pregnancy (MTP) Act 1971 00:20:12

- It was last amended in the year 2021

Indications of MTP:

i. Social (failure of contraceptive)
ii. Eugenic (chances of child to be born with serious physical or mental abnormalities)
iii. Therapeutic (continuation of pregnancy endangers life of the mother) and
iv. Humanitarian (pregnancy resulted from rape)

Who can perform MTP?

i. Any RMP with 6 months house job in OBG or
ii. RMP with 1 year experience in the dept. of OBG or
iii. Anyone who holds MD/Diploma in OBG or
iv. Have assisted in performance of minimum 25 MTPs, out of which 5 must have been performed independently (with this experience, can terminate pregnancy only up to 12weeks)

- As per MTP act 1971, the admission register should be maintained for at least 5 years → from the end of the calendar year

Medical termination of pregnancy (Amendment) Act, 2021 00:23:21

i. Opinion of 1 RMP for MTP up to 20 weeks

ii. Opinion of 2 RMP's for MTP of 20-24 weeks

iii. Can be done up to 24 weeks, only in cases of survivors of rape & fetal abnormality

iv. Failure of contraceptive in a woman on her partner, MTP can be done only up to 20 weeks

v. MTP can be done even after 24 weeks, in case of → substantial fetal abnormalities diagnosed by a medical board

Note: - MTP can be done at any time if it is immediately necessary to save the life of the pregnant woman

- Can be done up to 24 wks. only in cases of
  - Rape
  - Incest
  - Minors
  - Women with physical disabilities
  - Mentally ill women including those suffering from mental retardation

Criminal Abortion 00:28:47

- The most common complication is hemorrhage
- The most common cause of death is sepsis
- Ecbolics are drugs which causes uterine contraction

  → Ergot (most commonly used ecbolic in criminal abortion)

  Others are

  - Pituitary extract
  - Quinine
  - Cotton root bark
  - Diachylon (lead oleate)
  - Gossypium etc.
- Emmenagogues are the drugs which increase menstrual blood flow. Most commonly used is → Estrogens
- Abortion sticks acts by stimulation of uterine contraction
- Sex of the foetus can be recognized earliest at 4th month

Pseudocyesis/False Pregnancy/Phantom Pregnancy 00:32:35

- Seen in childless wife nearing menopause
- Sec 416 of Cr P C → If a woman is sentenced to death is found to be pregnant, the high court shall commute the sentence to imprisonment for life

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- 317 IPC → Exposure & Abandonment of child under 12 years, by parent or person taking care of it
- 318 IPC → Concealment of birth by secret disposal of dead body

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Extra Edge topics 00:36:34

- Fetal movements are felt by 24th week by placing hands on abdomen
- Fetal heart beats become detectable by ultrasound at 10th week
- Accurate determination (99-100%) of sex of fetus by ultrasound is at 13th week
- Pregnancy can be detected with absolute certainty at 16th week by X-ray
- Fetal heart sounds first heard between 18-20 weeks
- In a fetus nails reach the tip of the fingers at 8th month
- **Cupping**
  - It is a method of criminal abortion
  - A Diya is placed on the abdomen and is covered by a metal mug
  - The mug is pulled which results in placental separation and abortion

NATURAL SEXUAL OFFENCES

Classification of sexual offences 00:00:20

- Natural → Peno-vaginal penetration
  - It is as per the order of nature.
- Un-natural → Other than peno-vaginal penetration
  - It is against the order of nature.
- Sexual paraphilia → No sexual intercourse
- Sex-linked offences → No sexual intercourse

Rape 00:05:26

- Penetration of penis into vagina/mouth/urethra/anus.
- Insertion of any object/body part into vagina/urethra/anus.
- Application of mouth into vagina/urethra/anus.
- Manipulating the women to cause penetration into vagina/urethra/anus.
- Exception: Sexual intercourse by a man with his wife, >15years is not rape.
- Supreme court: If wife (15-18years) complains within 1year → Rape
- Minimum age of a girl to give valid consent for sexual intercourse → 18years
- Statutory rape → Sexual intercourse even with consent with a girl <18years

IPC sections 00:13:00

- 376 → Punishment for rape
- 376 (1) → 10years to life imprisonment
- 376(2)
  - Includes custodial rape.
  - Rape by a person in a position of authority in his custody.
  - 10years to life imprisonment (Till reminder of life).
- 376 (B)
  - Sexual intercourse with wife, living separately under a decree of separation, without her consent & on her complaint (It is not marital rape).
  - Cognizable and bailable
  - 2years-7years punishment
- 376 (C)
  - Sexual intercourse by a person, in position of authority, taking advantage of his official position to induce/seduce any women to have sexual intercourse with him, not amounting to rape.
  - 5years-10years punishment
- 376 (D)
  - Gang rape
  - 20years – life imprisonment
- 228 A

- Disclosure of identify of the victim of rape (up to 2 years)

- Sec. 357C CrPC → Free Rx to victims of Rape & Acid attack

  → Inform police

  - If not, punishable under Sec. 166B IPC (1 yr imp./Fine/Both)

    (All offences under POCSO ACT, 2012 should be informed to police

    If not, 6 months imp./fine/with both)

- Sec. 327(2) of Cr.P.C.-
  - The inquiry into and trial of rape shall be conducted in camera

Section 376D IPC – Gang rape

- Where a woman is raped by one or more persons constituting a group or acting in furtherance of a common intention, each of those persons shall be deemed to have committed the offence of rape and shall be punished with rigorous imprisonment for a term which shall not be less than 20years, but which may extend to life which shall mean imprisonment for the remainder of that person's natural life, and with fine.
- Rape is a male offence
- Acc. to S.C ruling, a 'woman' cannot be guilty of committing even gang rape.

- Sec. 357C Cr.P.C → Hospital should provide free treatment to the victims of rape and acid attack and Inform police.
- All offences under POCSO ACT, 2012 should be informed to police.

Tests 00:31:33

To detect

- Recent micro injuries → Toluidine blue test

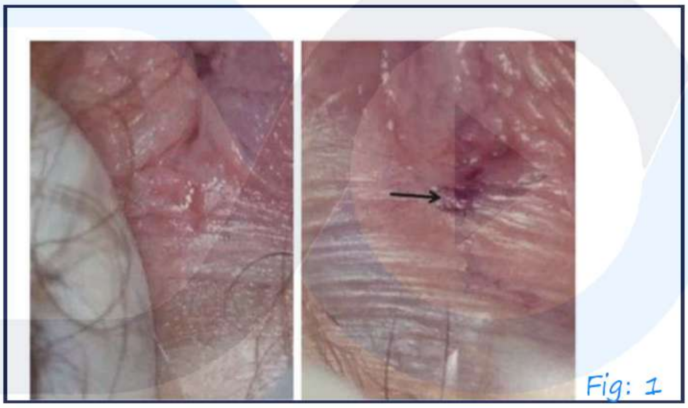

Fig: 1

- Recent sexual intercourse in males → Lugol's iodine test (positive upto 4 days if the part is unwashed).

Glaister keen rod 00:33:30

- Used to examine torn hymen.
- Presence of smegma is suggestive that the person did not have sexual intercourse in last 24hours.
- Smegma → Cheesy secretion of sebaceous glands, consisting mainly of desquamated epithelial cells on corona glandis.

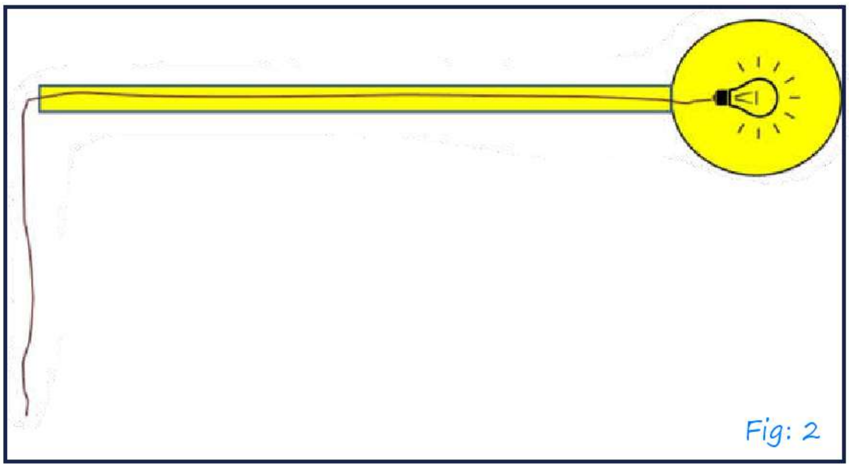

Fig: 2

Vaginal swab 00:35:41

- Vaginal swab to be taken within

  a. Upto 72 hours → for sperm detection

  b. Upto 96 hours → for semen detection
- Sperms are motile in vagina maximum upto 12 hours

Evidence to be collected and time lapse between assault and examination 00:36:34

- <72hours → All evidences including swabs should be taken.
- 72-96hours → Swabs only for semen, not for wet mount slide.
- >96huors → Evidences on the outside of the body & on materials.
- Exception: If the victim has not washed (or) bathed at all.
- Blue-white colour in UV rays is seen in semen

Section 497 IPC – Adultery 00:39:04

- Whoever has sexual intercourse with a person who is and whom he knows or has reason to believe to be the wife of another man, without the consent or connivance of that man, such sexual intercourse not amounting to the offence of rape, is guilty of the offence of adultery, and shall be punished with imprisonment of either description for a term which may extend to five years, or with fine, or with both.
- Wife shall not be punishable as an abettor.

S.C ruling (27/09/18)

- Adultery is not as criminal offence.
- It can be a ground for divorce.
- Abetment to suicide (306 IPC) → if evidence is produced and any spouse commits suicides.

Incest 00:42:06

- Sexual intercourse between 2 or more people, closely related by blood

  i. Oedipus complex → Mother & son

  ii. Electra complex → Father & daughter

  iii. Pharoan complex → Brother & sister → Most common
- Incest per se is not punishable, unless it amounts to rape

Extra Edge topics 00:44:42

Section 376(2) IPC

Rape

a. By a police officer
b. By a public servant
c. By military personnel
d. By an official personnel of jail/remand home
e. By a hospital management
f. By a relative/teacher/guardian who is in position of trust
g. During communal violence
h. On pregnant women
i. On a woman who is incapable of giving consent
j. By a person who is in a position to control (or) dominance
k. On a woman with mental (or) physical disability
l. Resulting in grievous bodily harms
m. Repeated rape on the same women

  - In India martial rape is not punishable

376 (1)	Punishment for rape	10years – Life imprisonment
376 (2)	Custodial rape + others	10years – Life imprisonment
376 (3)	Rape on women, <16years	20years – Life imprisonment

376 A	Rape resulting in death/PVS	20years - Life imprisonment/Death sentence
376 AB	Rape on women, <12years	20years - Life imprisonment/Death sentence
376 B	Sexual intercourse by husband during separation	2years – 7years
376 C	Sexual intercourse by a person in a position of authority	5years – 10years
376 D	Gang rape	20 years/life imprisonment
376 DA	Gang rape on women, <16years	Life imprisonment
376 DB	Gang rape on women, <12years	Life imprisonment/ Death sentence
376 E	Repeat offenders	Life imprisonment/ Death sentence
*** Life imprisonment means imprisonment for the remainder of that person's natural life. All the sub-sections of section 376 I.P.C. shall also include fine**		

- **All offences under POCSO ACT, 2012 should be informed to police**
- **Sexual Offences Against Children**

  A. Penetrative sexual assault:

  B. Aggravated penetrative sexual assault

C. Sexual assault

D. Aggravated sexual assault

E. Sexual harassment

F. Using child for pornographic purposes

- **Aggravated penetrative sexual assault:**

  It means Penetrative sexual assault (PSA) on a child

  1.By a police officer; or

  2.By a member of the armed forces or security forces; or

  3.By a public servant; or

  4.By the management or on the staff of a jail, remand home, protection home, observation home, or other place of custody or care and protection

  5.By management or staff of a hospital, whether government or private in that hospital; or

  6.By management or staff of an educational institution or religious institution

  7.By more than one person (gang penetrative sexual assault); or

  8.By using deadly weapons, fire, heated substance or corrosive substance; or

  9.Causing grievous hurt or causing bodily harm and injury or injury to the sexual organs of the child; or

  10. Physically incapacitates the child

  11. Causes the child to become mentally ill

12. Makes the child pregnant as a consequence of sexual assault
13. Inflicts the child with HIV or any other life-threatening disease or infection
14. Causes death of the child
15. Taking advantage of a child's mental or physical disability
16. PSA more than once (Repeated)
17. On a child below 12 years
18. PSA by a relative/guardian/foster parent/living in the same or shared household of the child
19. By the ownership/management/staff, of any institution providing services to the child
20. By a person in a position of trust or authority
21. Knowing the child is pregnant
22. Attempts to murder the child; or
23. During communal or sectarian violence or during any natural calamity or in similar situations; or
24. By a person who has previously convicted for any sexual offence
25. PSA on a child and makes the child to strip or parade naked in public

- Whenever the person has a knowledge of sexual offence, he has to report to the police and record the case contents. (under POCSO)

  - The police should provide care and protection and at the same time admit the child to shelter homes/ hospitals within 24 hrs
  - The police has to report to Child Welfare Committee & Special/Sessions court
- For medical examination:
  - Consent of the parent/guardian
  - Girl child should be examined by a lady doctor
  - In the presence of parents or any other person on whom child has trust or confidence
  - If not available, in the presence of a woman nominated by the head of medical institution

UNNATURAL SEXUAL OFFENCES

Unnatural sexual offences 00:00:25

- Punishable under Sec. 377 IPC

  1.Sodomy (Greek love/Buggery)

  - Anal intercourse

  2.Buccal coitus (Sin of Gomorrah)

  - Oral intercourse

  3.Bestiality → Intercourse with lower animals

  4.Tribadism/Lesbianism/Sapphism

  - Female homosexuality

    Active → Butch/Dike

    Passive → Femme

- S.C Decriminalized → Consensual sex between adults in a private space and not harmful to women/children.

Sodomy

- Active and passive agents.
- If the passive agent is a child, the child is known as Catamite and the act is known as → Pederasty
- If the passive agent is an old man, the act is known as → Gerontophilia
- Lateral buttock traction test is positive in habitual passive agent of sodomy.
- Manifestations of habitual passive sodomite

1.Anal sphincter loses its tone.

2.The anus is funnel or conical in shape.

3.There may be healed or active anal fissures.

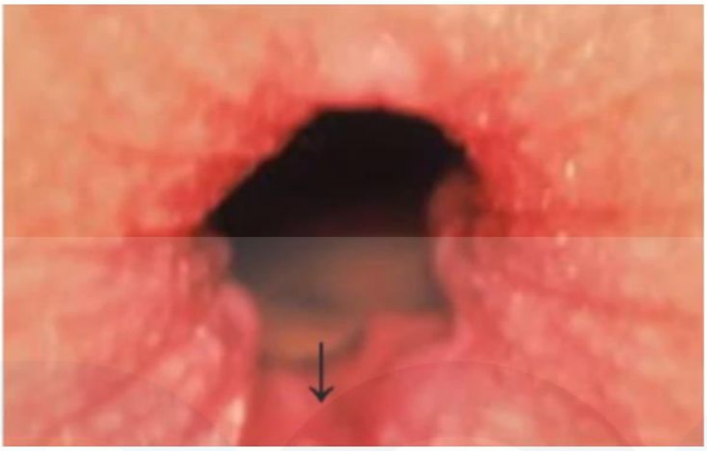

Fig: 1

- Zenanas → Males, genitals are intact → Wear female attire & behave like female

Fig: 2

- Hijras → Males, who are castrated and emasculated before puberty

Sexual paraphilia 00:10:31

- Algolagnia → Sexual pleasure from pain.
- Active algolagnia → Sadism → Sexual pleasure from giving pain.

- Passive algolagnia → Masochism → Sexual pleasure by receiving pain.
- Some times sadist & Masochist may indulge in these activities together. Then it is known as bondage.

Fetichism 00:11:50

- Sexual pleasure from handling a particular object clothing etc. (fetish objects) or part of the body other than sexual organs.

Undinism (Urolagnia) 00:12:48

- Sexual pleasure by urinating on somebody/being urinate upon (Gloden shower).
- Sexual excitation by sight/sound/thought of urine
  - Mixoscopia refers to observing the sexual inter course of another couples
  - Sexual intercourse between 3 people → Troilism
  - Sharing the wife with another → Extreme degree of troilism

Scatologia/Coprolalia 00:14:33

- Sexual pleasure is obtained through compulsive use of obscene language.

Telephone scatologia/Telephone scatophilia

00:15:00

- Sexual pleasure by making obscene telephone calls to a non-consenting recipient.
- Telephone scatologia is a type of exhibitionism.

Sexual oralism 00:16:01

- Licking the
  a. Anus → Annilingus/Rimming
  b. Vulva → Cunnilingus
  c. Penis → Pennilingus/Fellatio

Klismaphilia 00:17:11

- Sexual pleasure by use of enemas.
- Excessive sexual interest in
  - Males → Satyriasis
  - Females → Nymphomania

Hybristophilia 00:18:09

- An attraction to extremely violent criminals or a person who has committed a gruesome crime.

Zoophilia 00:18:45

- Sexual pleasure by non-human animals.

Formicophilia 00:19:15

- A form of zoophilia
- Sexual pleasure by insects crawling upon the body.

Transvestism (Eonism) 00:19:48

- Fetishistic transvestism → Sexual motivation

Fig: 3

- Dual role transvestism → No sexual motivation; but to experience opposite sex temporarily.

Pygmalionism 00:21:55

- Sexual pleasure directed toward a statue.
- Agalmatophilia → Love for an object of one's own creation.

Coprophilia 00:22:42

- Abnormal interest & pleasure in faeces & defecation.

Necrophilia 00:23:05

- Sexual attraction to dead bodies.
  - Sec 297 IPC (indignity to human corpse)

Necrophagia

- Eating flesh of corpse for sexual gratification
  - Sec. 297 IPC (Indignity to human corpse)

Mysophilia 00:24:05

- Sexual attraction to soiled, dirty foul or decaying material.

Frotteurism 00:24:30

- Sexual pleasure by touching/rubbing the genital organs or body.
- Sec 290 IPC (Public nuisance).
- Sec 354A IPC (sexual harassment).

Exhibitionism 00:22:53

- Sexual pleasure by exposing private parts in public places.
- Rare in females
- Exhibition is punishable under sections of IPC

  i. 290 → Public nuisance

  ii.294 → Obscene act

  iii. 509 → Insulting the modestly a female

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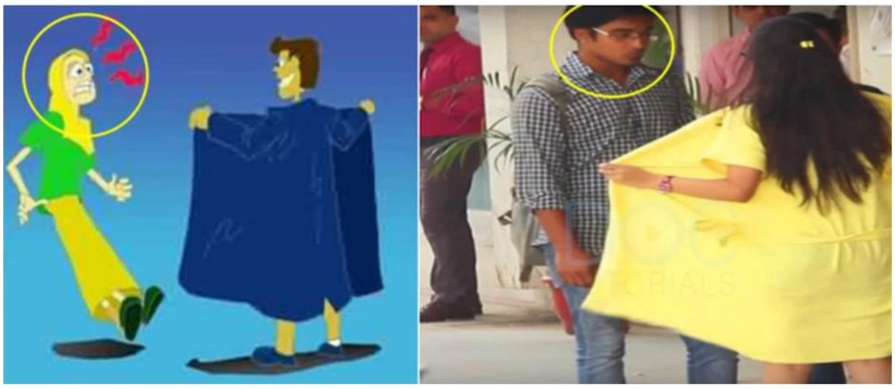

Fig: 4

Exhibitionism

- Flashing → Any body part normally covered
- Mooning → Exposing the buttocks
- Streaking → Running naked in public

Sex linked defenses 00:31:24

- Sec. 354 IPC & subsections are gender specific (Offences against a female).
- Sec 354 IPC → Outraging the modesty of a women.

354A → Sexual harassment 00:32:07

- Unwanted physical contact/Advances and sexual overtures.
- Demand/Request for sexual favours.
- Showing pornography against the will.
- Making sexually colored remarks.

354B → Disrobe 00:34:45

- Taking off one's clothes.

354C → Voyeurism (Scopophilia) 00:35:02

- Watching capturing image of a women engaging in a private act.

354D → Stalking 00:35:52

- Following/contacting a woman despite a clear indication of disinterest.
- 1st offence: Cognizable and bailable
- 2nd offence: Cognizable and Non-Bailable

INFANTICIDE, CHILD ABUSE AND SIDS

- Live birth according to Indian law is when any part of living child comes out irrespective of breathing/completely born.
- Infanticide
  - Deliberate killing of child below the age of 1 year.
  - Infanticide in India can be punished under section 302 IPC.
- Feticide
  - Killing of a fetus at any time prior birth.
- Filicide
  - Killing of a child by its own parents.
- Neonaticide
  - Killing of a child within 24 hours of its birth. (As per medical journals).

Intrauterine death 00:04:22

- If a foetus dies inside the uterus, it may undergo 4 different types of changes:

  1.Rigor mortis → Absent in < 7 months

  (As per Anil Aggrawal → 8 weeks,)

  [<8 weeks > <7m]

  2.Maceration → Aseptic autolysis (takes place when there is abundant Amniotic fluid).

  - Amniotic membrane should be intact.

3. Mummification → Desiccation (takes place when there is scanty Amniotic fluid).
   - Amniotic membrane should be intact.
4. Putrefaction → if the amniotic membrane is not intact, the bacteria invade and causes putrefaction.

Maceration 00:08:05

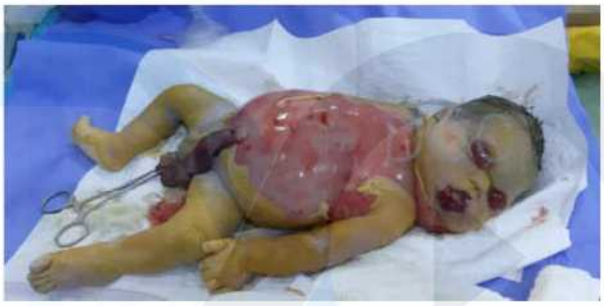

Fig: 1

- Studied and classified by Langley.
- Blisters appear in 24 hours, contains serous/serosanguinous fluid.
- Typical features seen in 3-4 days.
- It has got sweetish disagreeable odor.
- Body is soft, flaccid and flattens out when placed on a level surface.
- Abnormal mobility at the joints.
- Earliest sign of maceration → coppery – brown skin and skin slippage (12 hours)

Fig: 2

- Vagitus uterinus is a cry of unborn baby from uterus.
- Vagitus vaginalis is a cry of unborn baby from vagina.

Radiological signs of IUD 00:10:48

1.Robert's sign → Gas shadow within heart/great vessels

→ earliest sign (12 hours)

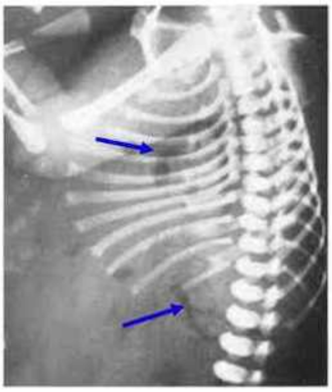

Fig: 3

2.Helix sign → Gas shadow within umbilical arteries.

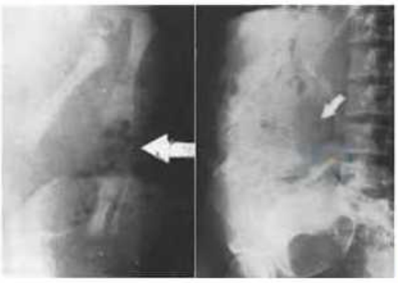

Fig: 4

3.Ball sign → Hyperflexion of spine

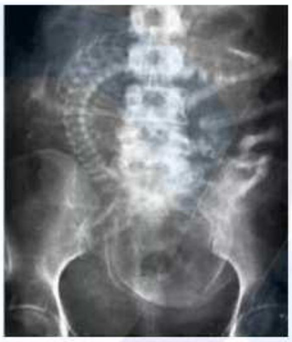

Fig: 5

Overcrowding of ribs

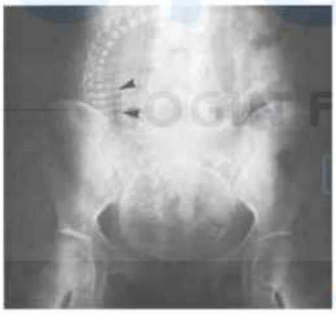

Fig: 6

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4.Spalding's sign → overlapping of cranial vault bones (1 week)

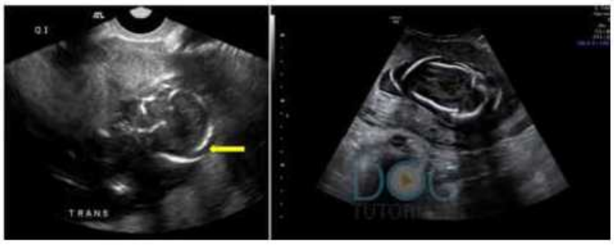

Fig: 7

5.Duel's halo sign → separation of subcutaneous fat from cranial bones

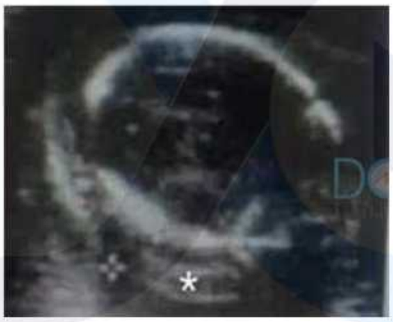

Fig: 8

Precipitate labor 00:14:24

- Expulsion of the foetus within 3 hours of the onset of contractions.
- If torn, umbilical cord usually torn at fetal end.
- Usually, fissured fracture of parietal bone.
- Intra cranial hemorrhages may be seen.
- No caput succedaneum/cephalohematoma
  - Caput succedaneum in a new born is oedema of the scalp due to the grip of the forceps.

Test to know live birth 00:18:56

i. **Hydrostatic/Raygat's/Breslau's first life**

- Look for floatation of lung.
- Specific gravity is 1.04 – 1.05 before respiration and 0.94 after respiration.
- The respired lung floats and un-respired lung sinks.
  - Pressure can remove tidal air, but not the residual air.

Fallacies of hydrostatic test

1. The expanded lungs may sink (false negative)
   - Acute edema
   - Pneumonia
   - Congenital syphilis
   - Atelectasis
2. The unexpanded lungs may float (false positive)
   - Putrefaction
   - Artificial respiration

Hydrostatic test is not necessary when

1. Fetus is a monster
2. Fetus is macerated or mummified.
3. Fetus is born before 180 days of gestation.
4. If stomach contains milk and.
5. Umbilical cord has separated, and a scar has formed.

ii. Stomach – Bowel/Breslau's second life

- It is done for the detection of presence of air in stomach and intestine.

iii. Plouquet's test

- Weight of the lung is 1/70th of body weight before respiration and 1/35th of body weight after respiration

iv. Foder's/Static test

- The weight of the lung is 35g before respiration 70g after respiration

v. Wredin's test

- Replacement of gelatinous tissue by air in middle car.

- Legal age of viability of a fetus →210 days (7 months)

Child abuse 00:33:22

- Battered baby syndrome (BBS)
  - Caffey's syndrome
  - Non – accidental injuries of childhood (NAIC)
  - Inflicted traumatic brain injury (ITBI)
  - Inflicted childhood neurotrauma (ICN)
- Repetitive physical injuries as a result of non-accidental violence.
- There may be deprivation of love, care, affection and nutrition.

- Usually seen in a child less than 3 years.
- Mismatch between history and physical findings.
- Multiple bruises of different colours (different age)
  - False accusation by adopted children of being mistreated by their adoptive mother is known as Cinderella syndrome.
  - Forced submersion in a fixed position can lead to Zebra stripe and 'Doughnut hole'' sparing.

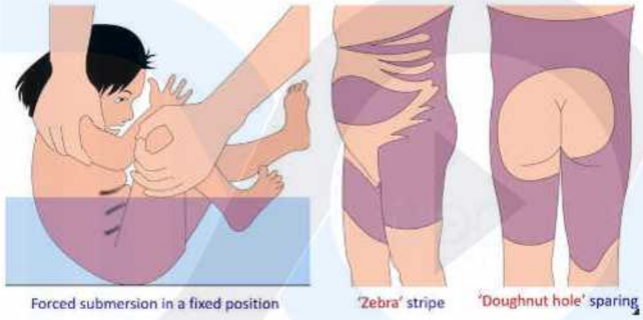
Forced submersion in a fixed position
'Zebra' stripe
'Doughnut hole' sparing

Fig: 9

Fracture in BBS 00:38:06

i. Skull → Egg shell fracture – most common

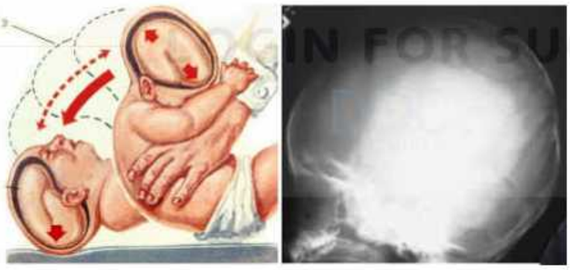

Fig: 10

ii. Ribs → nobbing fracture → string of bead appearance

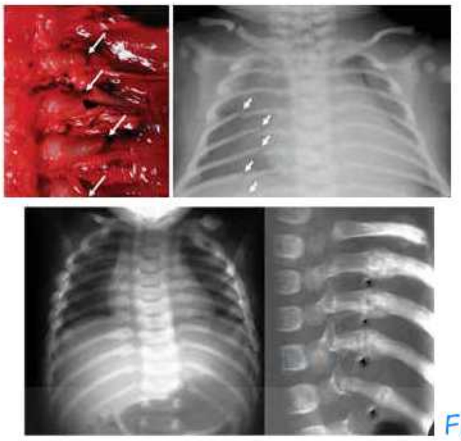

Fig: 11

iii. Long bones

- Bucket handle fracture → Avulsion of metaphysis

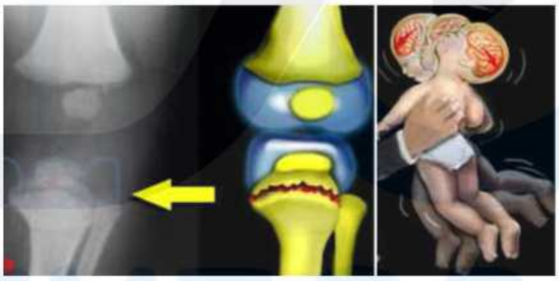

Fig: 12

- Corner fracture → Chip fracture of metaphysis

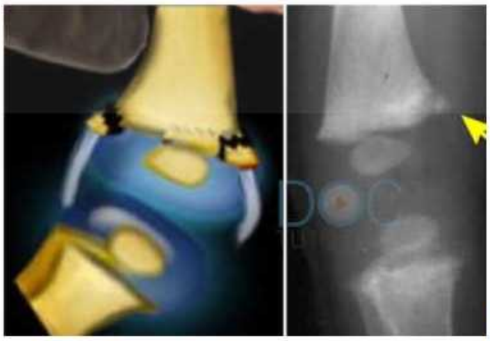

Fig: 13

Babygram

- AP and lateral x-ray of full bod

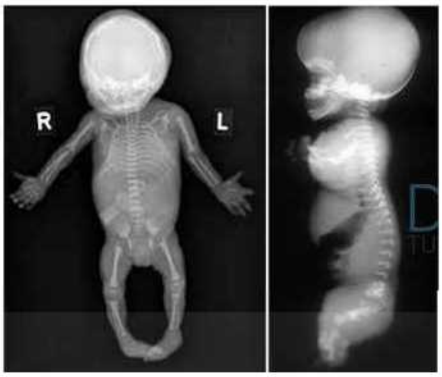

Fig: 14

Triad of shaken baby syndrome 00:42:46

1) Sub dural hemorrhages → most common

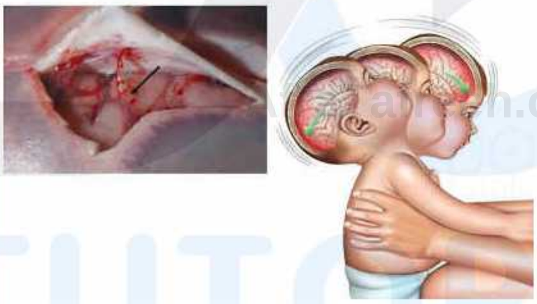

Fig: 15

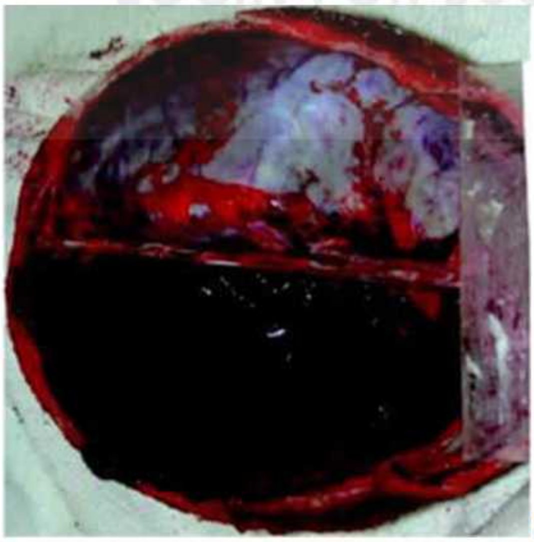

Fig: 16

2) Retinal hemorrhages → looks like flame
Smaller → Dot hemorrhages
Larger → Blot hemorrhages

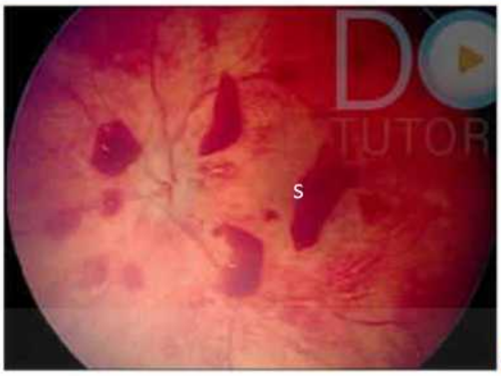

Fig: 17

3) Cerebral edema → because of continuous movement of the head.

- Rolling over of baby
  - Front to back → 4 months
  - Back to front → 5-6 months

Sudden infant death syndrome (SIDS) 00:47:25

- Also known as cot death/crib death
- Apparently healthy child found dead, usually in the night during sleep
- Age: from 2 weeks to 2 years, with a peak at 2-4 months
- Incidence: 0.6/1000 live births
- Season: More during winter than summer
- Sex: More in males than females
- Cause of death → not known, but most accepted hypothesis is "sleep apnoea".

FORENSIC PSYCHIATRY

- Forensic psychiatry is the application of knowledge of psychiatry into the administration of justice.

Mc Naughton's Rule 00:00:23

- "To establish a defence on the ground of insanity, it must be clearly shown that at the time of committing the act, the accused was labouring under such a defect of reason, from disease of mind, as not to know the nature and quality of the act he was doing or, if he did
- Does he know what he is doing?
  1. If No → Not liable
  2. If yes → Does he know what he is doing is right or wrong?
     - If No → Not liable
     - If yes → Does he know what he is doing is right or wrong?
     - If no → Not liable
     - If yes → Liable

DX TUTORIALS
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Sec 84 IPC 00:03:46

- Act of a person of unsound mind.
  - Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind is incapable of knowing
    - The nature of the act, or the
    - he is doing what is either wrong or contrary to law.
- The criminal responsibility of mentally ill person is dealt under sec 84 IPC which is derived from MC Naughton's Rule.

84 IPC → Criminal responsibilities of a mentally ill person

- Criteria for not to be liable
  - There should be unsoundness of mind
  - Should not know the nature of the act, or
  - Should not know that, whether it is right or wrong.

Note: In India there is no scope for partial/diminished responsibility

Criminal responsibility:

- Kleptomania → Liable
- Delirium → Not liable
- Automatism → Not liable

- Epilepsy → Not liable
- Somnambulism → 1st offence – Not liable
  Subsequent offence – Liable
- Hypnosis → Both hypnotiser & hypnotisee are liable.
- Involuntary intoxication → Not liable as per sec. 85 IPC; the one who intoxicated him is liable.
  voluntary intoxication → Liable as per SPC. 86 IPC

Run amok 00:14:11

i. Usually in chronic intoxication → Not liable under 84 IPC, as it is a psychiatric manifestation.

ii. Rarely in acute intoxication → Liable under 86 IPC (unless involuntary)

Durham's rule

- An accused is not criminally responsible if his unlawful act is the product of mental disease or mental defect.

Curren's rule

- An accused is not criminally responsible, if at the time of committing the act, the defendant, as a result of mental disease or defect, lacks substantial capacity to conform his conduct to the requirements of law.

[CCCC]

American Law Institute (ALI) test

- A person is not criminally responsible, if at the time of committing the act, as a result of mental disease or defect lacked substantial capacity either to appreciate the wrongfulness of his conduct or to conform his conduct to the requirements of the law.

Irresistible impulse test (New Hampshire doctrine)

- An accused is not criminally responsible, even if knows the and quality of his act and knows that it is wrong, if he is incapable of restraining himself from committing the act, because the free agency of his will has been destroyed by mental disease.
- According to this, a person who has committed crime under impulse is not liable.
- **Testamentary capacity** refers to the ability to make a valid will.
- **Lucid interval** is seen in both mental illness and head injury during lucid intervals, the person is responsible for civil and criminal acts.
- Abetment of suicide of child or insane person is punishable under 305 IPC.

Mental Health Care Act 2017 00:21:44

- This act presumes that any person who attempts suicide is having severe stress and is not punished under sec.309 IPC (attempted suicide).
- This act decriminalized suicidal attempt.
- Any person who attempts to commit suicide shall be presumed, unless proved otherwise, to have severe stress and shall not be tried & punished under sec 309 IPC.
- The appropriate govt. shall have a duty to provide care, treatment, and rehabilitation to a person, having severe stress and who attempted to commit suicide, to reduce the risk of recurrence of attempt to commit suicide.

DOC TUTORIALS
LOGIN FOR SUCCESS

Advance Directive (As per **Mental Health Care Act 2017**)

- Every person, who is not a minor, have a right to make an advance directive in writing, specifying:
  1. the way the person wishes to be cared/not to be cared and treated for a mental illness.
  2. The individual or individuals in order of precedence, he wants to appoint as his nominated representative

Advanced medical directive (As per Supreme court)

- Direction given by a person that, in future if he/she becomes terminally ill and becomes an incompetent patient whether to give medical treatment or not.

"Treatment of terminally ill patients bill 2016"

- According to "Treatment of terminally ill patients bill 2016", incompetent patient means a minor below the age of 16 yrs.

Mentally ill person 00:27:16

i. Independent person (voluntary admission)

- Admit

ii. Involuntary admission

- Relative/friend can take him to a mental health establishment.
- They have to refer the case to mental health review board for approval.
- If approved, admit up to 30 days
- If continuation is required, extension can be done with approval of MHRB for 90+ 120+ 180 days.

iii. Neglected/ill treated

- Complaint to police.
- Police takes the matter to the Magistrate.
- Magistrate will order for admission for a maximum period of 10 days for assessment.

Extra Edge 00:30:02

- Indian Lunacy Act, 1912 has been repealed by Mental Health Act, 1987
- Mental Health Act, 1987 has been superseded by Mental Healthcare Act 2017
- Insanity is an old term used loosely to denote any mental disorder or mental illness.
- The Indian Penal Code employs the term unsoundness of mind while referring to insanity.
- It is better to use term mentally ill person rather than using term such as insane or lunatic
- "Mental illness" means
  - A substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behaviour, capacity to recognize reality or ability to meet the ordinary demands of life,
  - Mental conditions associated with the abuse of alcohol and drugs,
  - But does not include mental retardation which is a condition of arrested or incomplete development of mind of a person, specially characterized by subnormality of intelligence

Mental Health Review Board (MHRB)

- It consists of →
  i. A District Judge, or an officer of the State judicial services who is qualified to be appointed as district judge or a retired district judge who shall be chairperson of the board.
  ii. Representative of the district collector or district magistrate or DC of the districts in which the board is to be constituted.
  iii. 2 members of whom one shall be a psychiatrist and other shall be a medical practitioner.
  iv. 2 members who shall be persons with mental illness or caregivers or persons representing organizations or persons representing organizations of persons with mental illness or care-givers or non-governmental organizations working in the field of mental health.

Mental Health Establishment:

- Any health establishment, Govt./trust/private or public, corporation, where persons with mental illness are admitted for care, treatment, convalescence and rehabilitation

FORENSIC SCIENCE

Semen 00:00:18

Derivatives of seminal fluid

- Testis: Spermatozoa + Epithelial cells
- Seminal vesicle: Choline + Lecithin
- Prostate: Acid phosphate + Spermine

Confirmatory tests 00:01:00

- Microscopy – presence of sperm
- Detection of sperm specific LDH isoenzyme by electrophoresis

Presumptive/Screening tests: 00:01:41

- UV light → Blue white color

→ Seminal stains on clothes can be identified by UV rays.

Fig: 1

- Seminal Acid Phosphatase (SAP) test → Most commonly done presumptive test for detection of semen.

- Barberio's test → spermine picrate (yellow needle shaped crystals)

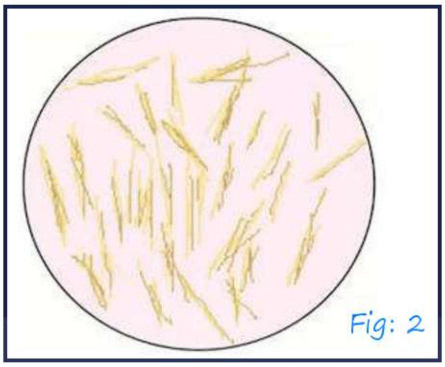
Fig: 2

- Florence test → Choline iodide (Dark brown rhombic crystals)

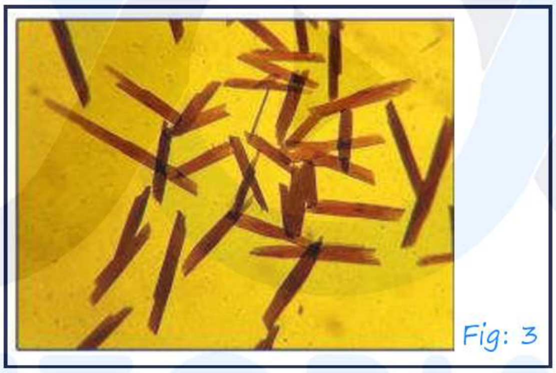
Fig: 3

- PSA (Prostate specific antigen)/P30 (P30 is better than SAP)

  p30 can be detected in dried and old stains **even up to 10 years** in material stored in room temp.
- Epithelial cells → FISH (Y chromosome) → Fluorescence in situ hybridization
- TLC → Choline + spermine

  Only test to detect both Choline and Spermine
- CPK → Even in old stains of 6 months can be detected

- Zinc test (Prostate)
- RSID (Rapid Stain Identification Series) test for semen Identification of semenogelin (Sg)
  - From seminal vesicle & Substrate for PSA
- Surest way to confirm that the stains are seminal in origin is LDH isoenzyme.
- The only test to detect both choline and spermine in seminal stain is Thin Layer Chromatography (TLC).

Blood 00:07:54

Screening (Presumptive) tests for blood

- Benzidine test → Dark blue colour.
  - Benzidine is carcinogenic & hence out dated)
- Phenolphthalein test/Kastle Meyer test → Pink or purple color.

  (Phenolphthalein test is more specific than Benzidine test, but comparatively less sensitive)
- Orthotolidine blue test.
- Leucomalachite green test (LGM)
- Tetramethyl benzidine test (TMB)
- Guaiacum test (First presumptive test developed)
- Luminol test → Best presumptive test
  - Sensitivity is 1:10,000,000 dilution
- All these tests utilize hydrogen peroxide.

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Luminol Test 00:10:43

- Reagent is Aminophthalhydrazide.
- Invisible blood stains can be identified even in case of washed blood.
- Detection up to minimum 7 wks.
- Luminol stray is used for demonstrating old washed-up blood stains.

Confirmatory Test for Blood 00:12:04

- Spectroscopic examination → The best confirmatory test in both recent & Old stains.
- Smear microscopy → useful only in fresh blood/stain, but not in a dried stain.
- Takayama's Haemochromogen crystal test (can be done in old stains)
  - Pink feathery crystals

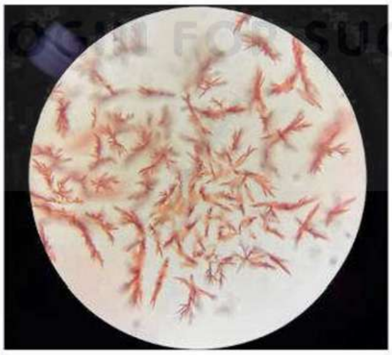

Fig: 4

- Haemin crystal test (Teicheman's test)
  - Yellowish red to brownish black rhombic crystals.

Fig: 5

- Thin layer chromatography (TLC)
- Electrophoresis

Best test to know:

- Grouping in old stains:
  - Acid elution or absorption elution test.
  - Absorption inhibition test
  - Latte's crust method.
- Age of stain
  - Immunoelectrophoresis
- Precipitin test is species specific test.
- Precipitin test can solve disputed maternity.
- 80% of the human population are secretors. They secrete ABO antigen in all their body fluids except in CSF.
- Tests to detect saliva
  - Phadebas test
  - Starch–Iodine test/α-amylase
  - Fluorescence spectroscopy
- Edelman test is used to detect fecal stains due to the presence of urobilinogen

- Milk can be detected by the presence of caseine & lactose.
- Colostrum can be detected by the presence of trypsin inhibitor.
- Urine can be detected by urea & creatinine.
- Lendrum stain is done for amniotic fluid embolism.
- Nile blue sulphate test
  - Fetal skin cells are stained with 0.1% nile blue sulphate dye.
  - >50% orange-colored cells indicate lung maturity.

Lie Detection 00:21:57

- (Revealing concealed information)

Narcoanalysis

- Sedatives or hypnotics are administered to induce narcosis
  - Scopolamine (hyoscine) → used in first case
  - Sodium thiopental (Sodium pentothal) – commonest
  - Amobarbital (sodium amytal) – common
  - 3-quinuclidinyl benzilate
  - Temazepam
  - Alcohol etc.
- Sodium thiopental and amobarbital is known as truth serum/drug

Polygraph (lie detector)

- Here whenever, the person tries to hide the truth, there will be some physiological activities like
  - RR
  - BP & HR
  - Electrodermal activity

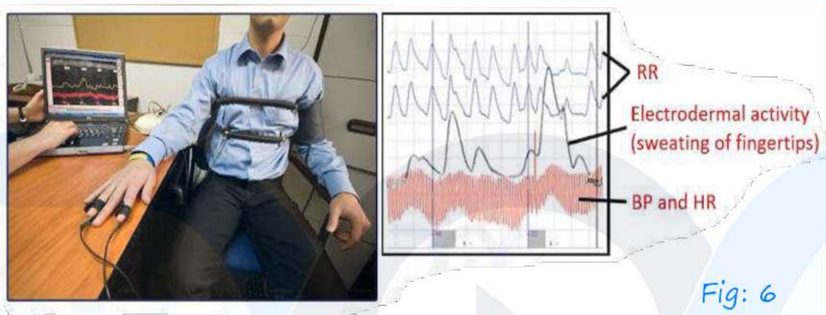
RR
Electrodermal activity (sweating of fingertips)
BP and HR

Fig: 6

Word Association

- Change in reaction time of the person's reaction to the given stimuli (Auditory or visual)

Hypnosis

- Invented by Lawrence Farwell
  - **M**emory and
  - **E**ncoding
  - **R**elated
  - **M**ultifaceted
  - **E**lectroencephalographic
  - **R**esponse (MERMER)

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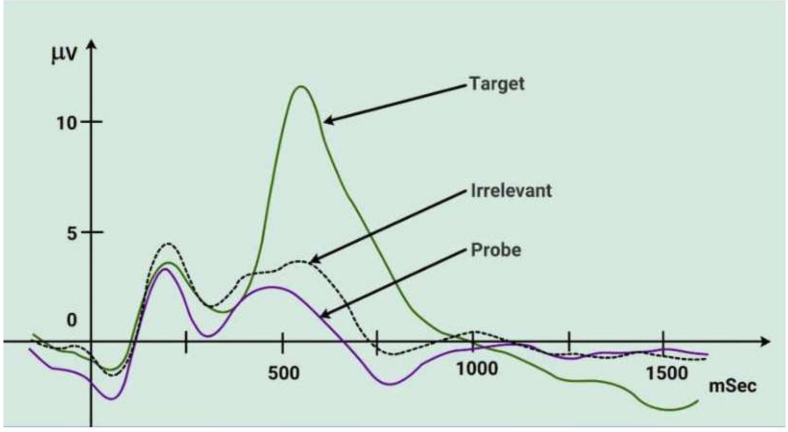

- Significant response is by P-300 wave

Brain fingerprinting

- Invented by Lawrence Farwell. Memory and Encoding Related Multifaceted Electroencephalographic Response (MERMER) Significant response is by P-300 wave.

Brain mapping

- Invented by Seiji Ogawa.
- Specialised MRI scan (Functional brain imaging with MRI → fMRI)
- Based on uptake of oxygen in the brain cells in response to questionnaire.
- Uses Blood-Oxygen- Level-Dependent (BOLD) contrast.

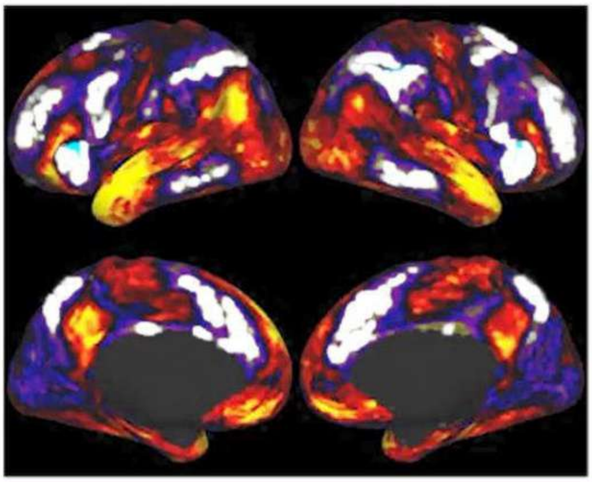

Fig: 7

Legal validity 00:28:44

- Article 20(3) → No person accused of any offence shall be uncompelled to be a witness against himself.
- S. 161(2) CrPC → A person cannot be bound to answer questions which exposes him to a criminal charge.
- S. 27 IEA → How much of information received from accused may be proved
- In 2020, S.C of India opined that, there tests cannot be forced upon any suspects.

DNA Fingerprinting 00:30:41

- It was discovered by Alec Jeffrey in 1985
- PCR is discovered by Kary Mullis.
- Identical twins have same DNA fingerprints but different fingerprints
  - DNA fingerprinting → Best to identify
  - Fingerprinting → Best to differentiate

The word "minisatellites", "STR", "RFLP" all are related to DNA fingerprinting.

- The most preferred method of DNA analysis currently used in crime laboratories is STR method.
- The venom of banded krait is used as chemical scissor.
- Methods of crime scene examination:
  - Spiral
  - Strip line
  - Grid
  - Zone/quadrant
  - Pie/wheel
- Bite marks may aid in:
  - Identification of accused
  - Assessment of type of teeth
  - Collection of DNA sample.

Extra Edge topics 00:30:41

- If the stain is blood, whether it is of human or animal (SPECIES SPECIFIC TEST
- Electrophoretic Methods
- Precipitin Methods
  - Ring precipitin test
  - Hemagglutination inhibition test (Antiglobulin consumption test)
  - Gel Diffusion technique
  - Double Diffusion in Agar Gel

  - Cross-over electrophoresis
  - Latex test
- Isoenzyme methods
- non-serum protein analysis
- Rapid stain identification of Human Blood (RSID-Blood) etc.
- pH of seminal fluid is 7.35 – 7.5
- Acid phosphatase activity of human semen per ml is
  - 340 - 360 Bodansky units or 2500 – 3500 Angstrom unitsVegetable stains can be differentiated from blood stains by the presence of Tannin.

STARVATION

Starvation 00:00:10

- In acute starvation feeling of intense hunger lasts for 30-48 hours.
- Total deprivation of water and food leads to death in about 10 days.
- Total deprivation of food leads to death in 60 days.
- Last subcutaneous adipose tissue to disappear in case of starvation is Bichat's buccal pad of fat.
- During starvation, the energy source for heart is aceto-acetate.
- In starvation, loss of 20% of protein is fatal.
- In starvation, loss of 40% of the original body weight is fatal.
- In starvation, loss of 80% of the fat is fatal.
- In starvation, the gall bladder may be distended.
- In starvation, all organs shrink except brain.
- Tissue paper like intestine walls is a sure sign of starvation.
- 'Baby farmer' refers to children starved by their parents.
- **Article 21 of constitution of India** ensures right to life but does not include right to die → So forcible feeding of person going to hunger strike is lawful in India.

- **Declaration of Malta** respect the autonomy of the patient, and suggests that the doctor should not feed forcibly in such cases. Feeding is allowed when the patient has lapsed into coma.

TORTURE

Torture 00:00:12

- **Falanga**
  - Aka, falaka/bastinado/foot whipping
  - Beating on the sole of the feet
  - both ears simultaneously.
- **Planton** –Forced standing
- **Telefono –** Slapping on both ears
- **Black slave**
  - Inserting heated metal skewer into anus.
- **Water boarding**
  - Head is immobilized and water is poured into the face leading to experience of drowning
- **Parrot's perch/jack**
  - Head down from a horizontal pole placed under the knees with wrist bound to the ankle.

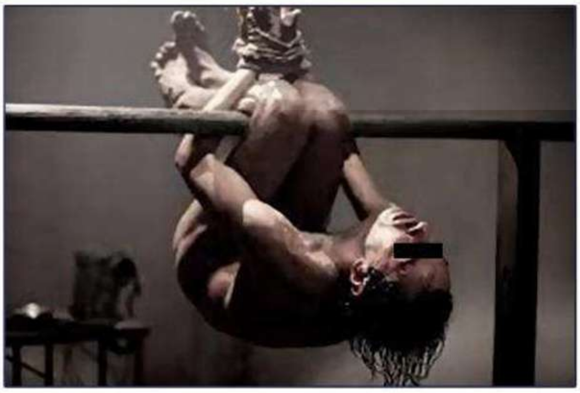

Fig: 1

- **Ghotna**
  - Rolling a wooden/iron rod up and down the thighs.
- **Sham execution**
  - Person is blind folded and threatened with an accident by an incoming vehicle with a sound.
- **Wet submarino**
  - Head is submerged in polluted water.
- **Dry submarino**
  - Head and face are covered with plastic bag.
- **Cattle prod and picana**
  - Electric torture
- **La parilla**
  - Victim is strapped to a metal frame subjected to electric shock.
- **Hog tying**
  - Tying the hands and feet together.
- **Hyderabadi goli**
  - A lathi or an iron rod smeared with chilli powder is slowly pushed inside the anus.
- **Aeroplane**
  - Body bent at right angle at the hip and arms raised behind back with head bent down.
- **Cheera/stretching**
  - Forcible abduction of hips
- **Chepuwa**

  - Legs and thighs are tied tightly with bamboo sticks to induce severe pain
- **Palestinian hanging/ strappado/ corda**
  - Hands are tied behind the back and suspended by a rope attached to the wrists
- **La Badera**
  - Suspended by wrists
- **Murcielago**
  - Person is suspended by ankles

EUTHANASIA

Euthanasia

- A peaceful passing.
- Euthanasia may be
  - Active → It is an act of commission.
    E.g., Injecting lethal drugs to the body to terminate the life of person.
  - Passive → It is an act of omission is discontinuing the cardiopulmonary resuscitation measures or tapering the life saving measures.
  - Voluntary → with the consent of the person.
  - Involuntary/without consent → without consent
  - Non-voluntary → Incapable of making the wishes.
- First country to legalize euthanasia is Netherland.
- The supreme court has permitted passive euthanasia in case of
  - Brain dead patients on ventilator.
  - Those in a persistent vegetative state.

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Advanced medical directive (As per Supreme court)

- Direction given by a person that, in future if he/she becomes terminally ill and becomes an incompetent patient whether to give medical treatment or not.

DEATH CERTIFICATE

Death certificate 00:00:06

- Medical certification of cause of death is issued by doctor in form no. 4 and form no. 4A
- The format of both is same
- Format 4 is used in institutional deaths
- Format 4A is used in non-institutional death

Death certificate

	Cause of death
I	
Immediate cause Antecedent cause	a. --------- b. ------ c. ------ d. ------
II	
Other significant causes	-------

- Immediate cause → I a
  - State the disease, injury or complications which caused death.
  - Not the mode of dying such as heart failure, asthenia etc.
- Antecedent cause → I a or Ib or Ic and Id……etc.

- Morbid conditions, if any, giving rise to the above cause.
  This is the condition given rise to immediate cause.
- Stage the underlyng conditions last.

- Other significant conditions → II
  - Contributing to the death.
  - But not related to the disease or conditions causing it.
- A doctor should not take fees for issuing death certificate

Example:

- A person died of septicemia due to peritonitis as a result of perforation of chronic duodenal ulcer
  - I a → septicemia
  - I b → peritonitis
  - I c → perforation of chronic duodenal ulcer. (DU)
  - I d → chronic DU
- A child died due to lobar pneumonia as a result of measles
  - I a → lobar pneumonia
  - I b → measles.

Specific requirements about certification of death:

- If the doctor in attendance is convinced that death is due to any natural cause:
  - He must issue a death certificate
  - He cannot charge ay fees for the same
  - He cannot delay if even if his own professional charges are not paid, and
  - The certificate must state the exact cause of death like 'coronary thrombosis' instead of the vague term 'heart failure'
- In case of suspicious / unnatural deaths don't issue death certificate

LAW RELATED TO DOWRY

Dowry Death 00:00:10

Sec. 304B IPC – Dowry death

- Death of a woman within 7yrs of her marriage.
- By burns or bodily injury or occurs otherwise than under normal circumstances.
- She was subjected to cruelty or harassment by her husband or any relative of her husband.
- For/in connection with any demand for dowry.

Punishment:

- 7 years to Life imprisonment
- Inquest to be done by a Magistrate
- Autopsy to be conducted by two doctors, preferably one lady doctor

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Sec. 498A – Dowry Harassment

- Husband or relative of husband of a women subjecting her to cruelty.
- Up to 3yrs + fine

Sec. 306 IPC – Abetment of Suicide

- Up to 10yrs + fine
- Penalty awarded according to dowry prohibition act – 1986 is Rs.15,000 fine and 5yrs imprisonment

THE CONSUMER PROTRCTION ACT, 2019

The Consumer Protection Act, 2019 [COPRA]

00:00:10

- This Act replaced Consumer Protection Act 1986

Consumer disputes redressal commission

00:00:30

Levels of Consumer Disputes Redressal Commissions:

	District	State	National
President	1	1	1
Min member	2	4	4
Term in years	4	4	4
Compensation	Up to 1 cr	> 1cr to 10cr	> 10 cr

- As per COPRA, the maximum period to a file a case after the knowledge of damage is 2 yrs.
- Time limitation for appeal:
  - From district to state → 45 days
  - From state to national commission → 45 days
  - From national commission to supreme court → 30 days

Doctors exempted from CPA:

- All doctors working in Government hospitals where patients are not charged at all
- All doctors working in private hospitals where services are rendered free of charge to everybody
- All doctors working in hospitals where only a nominal registration fee is collected, and all other services are free of cost

Doctors not exempted from CPA:

- All doctors working in private hospitals where all the patients are charged
- All doctors working in private hospitals where some patients are charged, and some are not charged

Exemption given:

- All Govt./private hospitals with free treatment or only with nominal registration fee.

Exemption not given:

- All private hospitals & hospitals where some patients are charged & some are not charged.

THE TRANSPLANTATION OF HUMAN ORGANS ACT

The Transplantation of Human Organs Act, 1994 (THOA) 00:00:10

- The act was later amended in 2011, known as Transplantation of Human Organs (Amendment) Act 2011.
- Transplantation of human organs act 1994 defines death as brainstem death.
- Brain-stem death should be certified by a Board of medical experts consisting of:
  - The RMP in charge of the hospital
  - An independent RMP, being a specialist
  - A neurologist or a neurosurgeon
  - The RMP treating the person
- The burden of proof lies on the specialist with Neurosciences
- If Neuro-specialist is not available,
  - An anesthetist or intensivist can be a member of board in his place
- Minimum age required for consent to donate organs as per THOA 1994 is 18 yrs.
- Urinary bladder is presently not being used for organ transplantation.

THOA 1994 Amendment 2011 – punishment

00:03:30

- Imprisonment → Up to 10yr
  Fine → Up to 20 lakhs
- Erasure of name
  - First offence → 3yrs
  - Subsequent offence → Permanent

Extra Edge topics 00:05:00

Homologous donation:

- Grafting of the tissue from one part of the body to another in the same patient
  - such as skin and bone

Live donation:

- It includes blood and bone marrow transfusion

Live organ donation:

- It includes kidney and parts of the liver & pancreas

Cadaveric donation:

- Organs taken from a person who is declared dead

Xenograft:

- Means grafting of animal tissue into humans

Allograft:

- Graft from a donor of the same species as the recipient but not genetically identical

Isograft:

- Graft of tissue between two individuals who are genetically identical (i.e., monozygotic twins)

Living donor transplant

- Who can donate?
- Near Relative donor
  - Father, mother
  - Spouse
  - Son, daughter
  - Brother, sister
  - Grandfather, grandmother
  - Grandson, granddaughter
- Other than near relative donor:
- Such a donor can donate only for the reasons of
  - Affection and attachment towards the recipient or
  - For any other special reason
- But should be approved by the authorization committee
- By Swapping
- Of near relative donors
- Between pairs of unmatched donor and recipient

PCPNDT ACT

Preconception and Prenatal Diagnostic Technique (prohibition of sex selection) ACT (PCPNDT ACT) 00:00:11

- The PNDT act 1994 was amended in 2003.
- Pre-natal diagnostic techniques can be conducted only for the purposes of detection of
  - Chromosomal abnormalities
  - Genetic metabolic disease
  - Haemoglobinopathies
  - Sex-linked genetic disease
  - Congenital anomalies
  - Any other abnormalities or diseases as may be specified by the central supervisory board.

Indications

- Age of pregnant women >35 years
- Pregnant women have undergone 2 or more spontaneous abortions/fetal loss.
- Pregnant women had been exposed to potentially teratogenic agents such as drugs, radiation, infection, or chemicals.
- Pregnant women have a family history of mental retardation or physical deformities such as spasticity or any other genetic disease.

- Any other condition as may be specified by central supervisory board.

Preconception and Prenatal Diagnostic Technique Act 2003, 00:02:38

- First offence
  - Up to 3yrs imprisonment
  - 5yrs penal erasure
- Subsequent offence
  - Up to 5yrs imprisonment
  - Permanent penal erasure.

THE EPIDEMIC DISEASES ACT 2020

The epidemic diseases act 2020 00:00:10

The Epidemic Diseases (Amendment) Act, 2020

- Aimed at protecting healthcare professionals against violence during health crises such as the covid-19 pandemic now ravaging the world

Punishment:

- Acts of violence → Imprisonment of 3 months to 5 years and a fine of ₹50,000 to ₹2,00,000
- In case of grievous injury → Imprisonment of 6 months to 7 years, with a fine of ₹1,00,000 to ₹5,00,000
- The offender will also be liable to pay compensation to the victim and twice the fair market value for damage of property

NDPS ACT 1985

The Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985 00:00:10

- Narcotic Drugs and Psychotropic Substance act was passed in the year 1985
- As per NDPS Act 1985, opium plants can be legally cultivated in Rajasthan, Uttar Pradesh and Madhya Pradesh

NDPS Act 1985

- Addicts volunteering for treatment enjoy immunity from prosecution
- Recommends treatment/rehabilitation of drug users & punishment for drug peddlers

Narcotic Drugs and Psychotropic Substances (NDPS) Act-1985

Offences	Penalty
Cultivation of opium, cannabis or coca plants without license	Rigorous imprisonment → up to 10 years + fine up to Rs. Lakh
Embezzlement of opium by licensed farmer	Rigorous imprisonment → 1- to 20 years + Fine of Rs/ 1 to 2 lakhs (regardless of the quality)

Production manufacture, possession, sale, purchase, transport, import inter-sate, export inter-state or use of narcotic drugs and psychotropic substances	Small quantity → Rigorous imprisonment years or dine up to Rs. 10,000 or both More than small quality but less than commercial quantity → Rigorous imprisonment up to 10 years + fine up to Rs. 1 lakh Commercial quantity → Rigorous imprisonment 1o to 20 years + fine Rs. 1 to 2 lakhs
Violations pertaining to controlled substances (precursors)	Rigorous imprisonment up to 10 years + fine Rs. 1 to 2 lakhs
Preparation of commit an offence	Half the punishment for the offence
Repeat offence	One and half times the punishment for the offence death penalty in some case
Consumption of drugs	Cocaine, Morphine, Heroin → Rigorous imprisonment up to 1 years or fine up to 20,000 or both other drugs → imprisonment up to 6 months or fine

	up to Rs 10,0000 or both. Addicts volunteering for treatment enjoy immunity from prosecution
Punishment for violation not elsewhere specified	Imprisonment up to six months or fine or both

NDPS Act 1985- The quantities for some common drugs

Drug	Small quantity	Commercial quantity
Amphetamine	2 grams	50 grams
Buprenorphine	1 gram	20 grams
Charas/Hashish	100 grams	1 kg
Cocaine	2 grams	100 grams
Codeine	10 grams	1 kg
Diazepam	20 grams	500 grams
Ganja	1 kg	20 kg
Heroin	5 grams	250 grams
LSD	2 mg	100 mg
MDMA	0.5 gram	10 grams
Methaqualone	20 grams	500 grams
Morphine	5 grams	250 grams
Opium	25 grams	2.5 kg

IPC, CRPC AND IEA

Sections of Indian Penal Code (I.P.C) 00:00:53

- 34 → Acts done by several persons in furtherance of common intention
- **44** → Injury
- 45 → Life
- (The word "life" denotes the life of a human being, unless the contrary appears from the context)
- 46 → Death
- (The word "death" denotes the death of a human being, unless the contrary appears from the context)
- **51** → Oath and solemn affirmation
- 54 → Commutation of sentence of death
- 55 → Commutation of sentence of imprisonment for life
- **82** → < 7 years: Not liable for criminal act
- 83 → 7 to 12 years: May/may not be liable for criminal act (Depending on mental maturity)
- **84** → Criminal responsibility of a mentally ill person
- 85 → Involuntary intoxication: Not liable for criminal act
- 86 → Voluntary intoxication: Liable for criminal act
- 87 → > 18 years, can give consent for surgical procedure
- 88 → Act done by consent in good faith for person's benefit
- 89 → < 12 years – Parent/guardian can give consent

- 90 → Defines invalid consent
  - Consent is invalid when given:
- Under fear or misconception or
- Under intoxication or
- By a mentally ill person or
- By a child < 12 years
- **92** → Consent in emergency
- 93 → Communication made in good faith
- 166B → Punishment for non-treatment of victim of rape/acid attack and for not informing
- Police about a case of Rape or Acid attack
- 172 → Absconding to avoid service of summons
- **174** → non-attendance for summons
- 175. Omission to produce document to public servant by person legally bound to produce it
- 176 → Omission to give information to public servant
- 177 → Furnishing false information
- 178 → Refusing oath or affirmation
- 188. Disobedience to order duly promulgated by public servant
- **191** → Giving false evidence (Perjury) - Definition
- **192** → Fabricating false evidence – Definition
- **193** → Punishment for Sec. 191, 192 and 197 IPC (Up to 7 years of imprisonment)
- **197** → Issuing or signing false certificate – Definition
- 198 → Using as true a certificate knowing to be false
- **201** → Causing disappearance of evidence
- 202 → Intentional omission to give information

- 203 → Giving false information respecting an offence committed
- 204 → Destruction of document or electronic record to prevent its production as evidence
- **228A** → Punishment for disclosure of identity of rape victim
- **269** → Negligent act likely to spread infection of disease dangerous to life
- **270** → Malignant act likely to spread infection of disease dangerous to life
- **271** → Disobedience to quarantine rule
- 272 → Adulteration of food or drink intended for sale
- 273 → Sale of noxious food or drink
- 274 → Adulteration of drugs
- 275 → Sale of adulterated drugs
- 276 → Sale of drug as a different drug or preparation
- 277 → Fouling water of public spring or reservoir
- 284 → Negligent conduct with respect to poisonous substance
- **290** → Punishment for public nuisance (Frotteurism, Exhibitionism)
- **294** → Obscene acts and songs (Exhibitionism)
- **297** → Trespassing on burial places/ wounding the feelings or religion of any person/indignity
  - To any human corpse (Necrophilia & Necrophagia)
- 299 → Culpable homicide - Definition
- **300** → Murder – Definition

- 301 → Culpable homicide by causing death of person other than person whose death was intended
- **302** → Punishment for murder
- **304** → Punishment for culpable homicide not amounting to murder
- **304A** → Causing death by negligence (Up to 2 years of imprisonment/Fine/Both)
- **304B** → Dowry Death
- 306 → Abetment of suicide
- **307** → Attempt to murder
- **308** → Attempt to commit culpable homicide
- 309 → Attempt to commit suicide
- **Sec. 312 to 316 deal with criminal abortion**
- **312** → Causing miscarriage (with consent)
- **313** → Causing miscarriage without woman's consent
- **314** → Death of mother caused due to miscarriage
- 315 → Preventing child being born alive or to cause it to die after birth
- 316 → Causing death of quick unborn child by act amounting to culpable homicide
- **317** → Exposure & abandonment of child under 12 years, by parent or person having care of it
- **318** → Concealment of birth by secret disposal of dead body
- **319** → Hurt
- **320** → Grievous Hurt
- **324** → Voluntarily causing hurt by dangerous weapons or means

- **326** → Voluntarily causing grievous hurt by dangerous weapons or means
- **326A** → Voluntarily causing grievous hurt by use of acid, etc.
- 326B → Voluntarily throwing or attempting to throw acid, etc.
- 334 → Voluntarily causing hurt on provocation (Up to 1 month imprisonment/Fine/Both)
- 335 → Voluntarily causing grievous hurt on provocation
- 336 → Act endangering life or personal safety of others
- 337 → Causing hurt by an act endangering life or personal safety of others
- 338 → Causing grievous hurt by an act endangering life or personal safety of others
- 341 → Punishment for wrongful restraint
- 342 → Punishment for wrongful confinement
- 351 → Assault – Definition
- 352 → Punishment for assault
- **354** → Indecent assault (Outraging the modesty of a female)
- **354A** → Sexual harassment
- **354B** → Disrobe
- **354C** → Voyeurism
- **354D** → Stalking
- **Sec. 361 to 369 IPC deal with kidnapping**
- 361 → Kidnapping from lawful guardianship (Any minor under 16 years male, or under 18 years female or any person of unsound mind)

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- 362 → Abduction — Whoever by force compels, or by any deceitful means induces, any
- person to go from any place, is said to abduct that person
- 363 → Punishment for kidnapping
- 366 → Kidnapping, abducting or inducing woman to compel her marriage, etc.
- 366A → Procuration of minor girl (< 18 years) for illicit intercourse
- 366B → Importation of girl (< 21 years) from foreign country for illicit intercourse
- 369 → Kidnapping or abducting child under ten years with intent to steal from its person
- **375** → Rape: Definition
- **376** → Punishment for rape
- **377** → Unnatural sexual offences
- 379 → Punishment for theft
- 380 → Theft in dwelling house, etc.
- 392 → Punishment for robbery
- 395 → Punishment for dacoity (5 or more persons)
- 497 → Adultery (Not a criminal offence as per Supreme Court)
- **498A** → Dowry harassment
- 509 → Word/gesture/act intended to insult the modesty of a woman (Frotteurism/exhibitionism)
- 510 → Misconduct in public by a drunken person

Sections of criminal procedure code (CR.P.C)

00:12:17

- **39** → Duty to give information (E.g., Death on operation table, Homicidal cases etc.)
- **53** → Examination of accused by medical practitioner at the request of police officer
- When a person is arrested & brought to the RMP for examination, he can proceed with the exam. even without consent at the request of a police officer not below the rank of sub- inspector,
- Whenever the person of a female is to be examined under this section, the examination shall be made only by, or under the supervision of a **female** RMP
- 53A → Examination of person accused of rape by RMP (Protocol)
- 54 → Examination of arrested person by RMP at the request of the arrested person
- 61 – 69 → Summons
- 164A → Examination of the victim of Rape (Protocol)
- **174** → Police inquest
- **176** → Magistrate inquest
- 312 → Expenses of complainants and witnesses (Subject to any rules made by the State Government, any Criminal Court may, if it thinks fit, order payment, on the part of Government, of the reasonable expenses of any complainant or witness attending for the purposes of any inquiry, trial or other proceeding before such Court under this Code

- **327(2)** → In camera trial (Proceeding carried out in private, in the absence of the public and the press) E.g., Trial of Rape
- **357C** → All hospitals should provide first-aid or medical treatment free of cost to the victims of
- Rape & Acid attack and shall immediately inform the police
- **416** → If a woman sentenced to death is found to be pregnant, the High Court shall commute the sentence to imprisonment for life

Indian Evidence Act (I.E.A) 00:15:43

- Sec.3 : Evidence
- Sec.32 (1) : Dying declaration
- Sec.45 : Expert Witness
- Sec. 141 : Leading question
- Sec.154 : Hostile Witness

GENERAL TOXICOLOGY AND CAUSTICS

General toxicology 00:00:17

- The ideal homicidal poisons are Thallium, Arsenic and Aconite.
- Thallium is known as the poisoner's poison.
- The MC homicidal poison is Arsenic (?)
- The ideal suicidal poisons are Opium, Barbiturates & Aluminium Phosphide.
- Commonly used suicidal poison is Insecticides.
- Stupefying poisons → a) Chloral hydrate b) Datura and c) Cannabis
- The best emetic is syrup of Ipecacuanha.
- The best method to induce emesis is gag reflex
- Emesis is virtually obsolete now.

Gastric lavage 00:06:25

- Most commonly used device is Ewald's tube.
- Length → 150 cm; Diameter → 1cm

Fig: 1

- Edlich tube → Better than Ewald's tube

Fig: 2

- Lavacuator tube → The best

Fig: 3

- Ryles tube → Not suitable for gastric lavage.

Fig: 4

- Best position for gastric lavage is left lateral

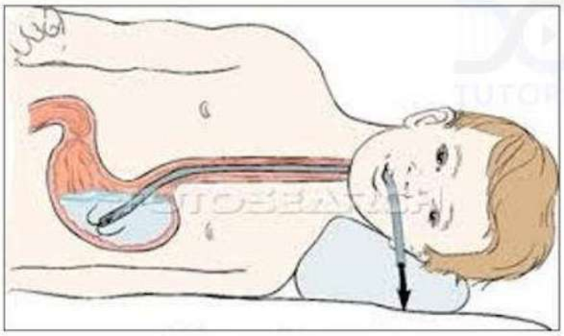

Fig: 5

- Gastric lavage is indicated in all cases of acute poisoning ideally because of fear of aspiration.
  Most common solution used for gastric lavage is water/saline.
- 1:5000 $KMnO_4$ is used as gastric lavage fluid in oxidizable poisons (Alkaloids, Salicylates etc.)
- 1:500 solution of $KMnO_4$ is used as gastric lavage in case of poisoning by opium.

Indications

- Useful anytime within 2-3 hrs after ingestion of a poison.
- Lavage up to 6-12 hours in cases of:
  - Anticholinergics
  - Morphine
  - Tricyclic antidepressants
  - Salicylates

Contraindications

- All corrosives except carbolic acid.
- Sharp & pointed material.
- Oesophageal varices
- Haemorrhagic diathesis
- Comatose patients
- Impaired gag reflex
- Volatile poisons
- Marked hypothermia

- Significant electrolyte imbalance
- Advanced pregnancy
- The best method to avoid aspiration of fluids during gastric lavage in a comatose patient is by introduction of a cuffed endotracheal tube before Lavage.

Chelating agents 00:13:56

- They are chemical compounds, react with metal ions to form a stable, water-soluble complex.
- Chelating agents are chemical antidots.

1. **Only Oral**

   DMSA (Succimer) → overall Best

2. Only Parenteral

   BAL (I.M.) → BAL for MAL, DOC in Mercury

   → Contraindicated in Cadmium, Organic mercury and Iron

   EDTA (I.V.) → Contraindicated in Mercury

3. Both Oral and Parenteral

   DMPS (I.V.)

   Penicillamine (I.V.) → DOC for Copper

   Deferoxamine (I.M.) → DOC in iron and used in toxicity with

   Radioactive heavy metals

- Chelation therapy is not useful in organic mercury

  E.g., in Minamata disease → caused by Methyl Hg

- True about DMSA is
  - It is superior to EDTA in the treatment of Pb poisoning (doesn't redistribute Pb to the brain)
  - It can be given in Glucose -6-PD deficiencies.
  - It is less nephrotoxic.
- BAL, DMSA & DMPS
  - Mercury
  - Arsenic
  - Lead
- BAL is contraindicated in poisoning by cadmium, as it increases nephrotoxicity.
- BAL is contraindicated in organic mercury as it causes redistribution of organic Hg to brain.
- BAL is contraindicated in iron as it causes severe vomiting.
- DOC in toxicity with Radioactive heavy metal is deferoxamine.
- D- Penicillamine is used in the treatment of poisoning by copper, mercury, lead.
- Penicillamine is a DOC for copper.
- The best use of penicillamine is Wilson's disease.
- Chemical antidote for silver nitrate is common salt.
- Maximum diaphoretic action is seen with pilocarpine nitrate.
- Activating charcoal is ineffective in poisoning by
  - H → heavy metals
  - A → Alcohol (ethyl, methyl)

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  - C → Corrosives, Carbamates, Cyanide
  - O → OP
- Minimum punishment for selling spurious drug likely to cause death as per 'The drugs and cosmetics (Amendment) act, 2008' is 10 years.

Extra Edge topics 00:26:20

Abortifacient Drugs

- Calotropis
- Oleanders
- Aconite
- Croton
- Semecarpus anacardium
- Cantharides
- Ergot
- Lead
- Arsenic
- Mercury
- KMNO4 etc.

Cattle poisons

- Abrus precatorius
- Oleanders
- Calotropis
- Aconite
- OP

- Arsenic
- Strychnine
- Zinc phosphide
- Nitrates etc.

Arrow poisons

- Abrus precatorius
- Croton oil
- Calotropis
- Aconite
- Strychnine
- Curare
- Conium and
- Snake venom

Aphrodisiacs

- Cantharides
- Cocaine
- Cannabis
- Opium
- Strychnine
- Arsenic etc.
- Cathartic of choice in adults → Sorbitol (D-glucitol)
- The most specific analytical method for poison identification is:
  - Gas Chromatography – Mass spectrometry

Coma Cocktail:

- Combination of 3 medicines can be given in unknown poisoning with coma
  1. Dextrose (50%) : 100 ml
  2. Naloxone : 2 mg,
  3. B1 (Thiamine) : 100 mg

Brompton's cocktail:

- Was given to terminally-ill individuals (especially cancer patients) to relieve pain
- Made from morphine or heroin, cocaine, highly-pure ethyl alcohol and sometimes with chlorpromazine to counteract nausea

Poison	Solution for gastric lavage
Most poisons (known/unknows)	Water or saline
Oxidizable poisons (Alkaloids, salicylates etc.)	KMNO4 (1:500 in opium poisoning
Cyanides	Sodium thiosulphate
Oxalates	Calcium gluconate
Iron	Deferoxamine

Composition of universal antidote

1. Magnesium oxide (1 part) : Neutralizes acid without gas formation
2. Activated charcoal (2 parts) : Adsorbs alkaloids
3. Tannic acid (1 part) : Precipitates alkaloids

Chemical antidotes

Poison	Antidote	Action
Silver nitrate c	Common salt	Forms silver chloride
Mercury chloride	Albumin	precipitates
Arsenic	Dialyzed iron	neutralizes
Copper sulphate	K ferrocyanide	Forms cupric ferrocyanide
Alkalis	Tannic acid	Precipitates
Acids	Alkalis (weak)	Neutralizes
Alkalis	Acids (weak)	Neutralizes

Diagnostic odour in poisoning

Garlicky	Arsenic, P OP, thallium, Selenium, Tellurium
Bitter almond	Cyanide, Prussic Acid
Burnt rope	cannabis
Fishy/musty (garlicky also)	ZnP, AIP
Shoe polish	nitrobenzene
Acrid (Pear like)	Chloral hydrate, Paraldehyde (C>P)
Kerosene	Organophosphates
Carrot/Mousy	Hemlock(conium)
Rotten egg	H_2S, Disulfiram, carbon disulphide, NAC
Acetone (Apple like)	Chloroform Ethanol, Isopropanol
Wintergreen	Methyl salicylates
Moth balls	Camphor, Naphthalene
Hospital odour	Carbolic acid
Sewer gas smell	H_2S

Drugs and cosmetics rules, 1945

- *Classification of drugs in schedules:*
  - C → Biological and special products
  - E →List of Poisons

- F → Vaccines and Sera
- G → Hormonal preparations
- H → Drugs/poisons to be sold only on prescription of RMP
- J → Diseases for cure of which no drug should be advertised
- L → Antibodies, Antihistaminic, chemotherapeutic agents
- S → List of various cosmetics and toiletries
- X → Potential drug of Abuse (Barbiturates, Sedatives, Amphetamines, etc.)

Drug	Slang Name/S
Ganja	Herb, Grass, Weed, Marijuana, Marihuana, Rope, Mary Jane, Pot, Reefer, Purple haze
Heroin (Diacetyl morphine)	Brown sugar Dope junk, Smack, H
Cocaine	Coke, Snow, Cadillac, White lady, lay, snuff, snort, C etc.
Phencyclidine	Agnel dust, PCP, Cadillac
LSD	Acid, battery acid, flash, Purple heart, Golden dragon, Blotter, Purple haze

Amphetamine	Speed, Meth, Crystal, Chalk Ice, Glass, Crank
MDMA	ECSTACY, XTC
MDEA	Eve
MDA	Love Drug

Drug	Slang Name/E
Hot Shot	Heroin/Strychnine
Crack/ (smokable form)	Cocaine + Baking soda
Beam me up	Crack dipped in phencyclidine (PCP)
Michey Finn	Alcohol + chloral hydrate
Date rape drugs	Gam Hydroxy Butyric acid (GHBA) Flunitrazepam (Rohypnol,) Alcohol (MC)< ketamine
Candy Flipping	LSD+ MDMA
Speedball (Depressant + stimulant)	Heroin + Cocaine

Poison	Specific antidotes
Arsenic	DMSA, DMPS, BAL
Amanita phalloids	Benzyl Penicillin
Amanita muscaria (Fly Agaric)	Atropine (Controversial)

Benzodiazepines	Flumazenil
Botulism	Guanidine?
Carbon Monoxide	Hyperbaric Oxygen
Copper	Bal/F/b Penicillamine
Cyanide	Amyl Nitrite, Ba Nitrite, Ba Thiosulphate (Eli-Lilly Kit) Hydroxocobalamin (vitamin B12 precursor) 4-dimethylmaniphenoal (4-DAMP) Par-Amino-Propiophenone (4- PAPP) Di cobalt Edetate (Di cobalt EDTA, Kelocyanor) Alpha-ketoglutaric acid Methylene blue is not an antidote

Poison	Specific Antidotes
Coumarin Derivatives	Phytonadione (Vitamin K1)
Ergotism	Sodium nitroprusside
Heparin	Protamine sulphate
H2S	Nitrites
Iodine	Sodium thiosulphate, Starch
Iron	deferoxamine
Lead	DSMA, DMPS, EDTA, BAL

Mercury	BAL, N-Acetyl penicillamine, D-Penicillamine
Methemoglobinemia (Nitrites)	Toluidine Blue
Opiates	naloxone
Paracetamol	N-Acetyl cysteine (Microcyst), Methionine
Phosphorus	KMNO4
Thallium	Prussian Blue (Potassium hex Cyanoferrate)

Poisons which mimic natural disease

1	Arsenic	Cholera, fading Measles, Addison's Disease
2	Strychnine	Tetanus
3	Zinc	Malarial chills
4	Thallium	Natural death, GB syndrome, porphyria
5	Di-nitro compounds	thyrotoxicosis
6	Organophosphates	Brachial asthma
7	Bromides, Iodides	acne
8	Iodine	Mumps
9	Mercury	Diphtheritic colitis
10	Manganese	parkinsonism

11	Oxalic acid, Ethylene glycol	Tetany
12	Phosphorous	Hepatic failure
13	Aconite	Myocardial infarction
14	KMNO4	Tertiary syphilis

Effect of poison on pupil

Miosis	Mydriasis	Nystagmus
Barbiturates,	Alcohol	Alcohol
Benzodiazepines	Amphetamines, antihistamines	barbiturates
Carbamates	Cocaine, CO, cyanide	Carbamazepine
Caffeine	Datura	Phencyclidine
Carbolic acid	Ephedrine	phenytoin
Nicotine		
Opiates		
Organophosphate		

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Hemodialysis

- Haemodialysis is useful in Chloral hydrate, Paraldehyde, Quinine, Strychnine and the poisons listed below (BLAST-EID):
  - **B** → Barbiturates, Bromides, Boric Acid
  - **L** → Lithium

- **A** → Alcohol (Ethanol, Methanol), Amphetamine
- **S** → Salicylates
- **T** → Theophylline, Thiocyanates
- **E** → Ethylene glycol
- **I** → Isoniazid
- **D** → Depakote

Hemodialysis is Not useful in

- Kerosene
- Benzodiazepines
- OP
- Digitalis
- Heroin
- Chloroquine
- Copper sulphate

Coloration of mucous membrane of stomach

Green	Ferrous sulphate
Blue	Amytal, $CuSO_4$, Dextropropoxyphene
Pink	Soneryl
Slate	Mercury
Black	Sulfuric acid, acetic acid
Grey	Hydrochloric oxalic acid (blackened by blood)
Yellow/Dark brown	Nitric acid

Buffed white /Greyish white	Carbolic acid
Grey white	Caustic alkalis
Blue/Green	Copper
Brown	Iodine, Cresols (Leathery)
Yellow	Phosphorus

Poisons causing pct necrosis

- Lysol, Phenol, Mercury, Cadmium (Important poisons)
- Others: CCl4, Oxalic acid, Ethylene glycol
  - Lead, Arsenic, Gold
  - Mushrooms
  - Antibiotics (gentamycin, sulphonamides, cephalosporin)
  - Anesthetic agents (halothane, methoxyflurane)
  - Barbiturates, Salicylates,
  - X-Ray contrast material

Poisons and eye

Eye changes	Poison
Corneal deposit	amodiaquine
Xanthopsia	aconite
Ptosis	Thallium, Gelsemium, Botulism toxin Elapids
Hippus	Aconite
Deposition in lens	Mercury

Complete/partial blindness	Methyl alcohol, arsenic, chloroquine Ergot, Pb, Hg, Tobacco
Corneal stippling	chloroquine
Retinal stippling	Lead, chloroquine, Phenothiazines
Papilledema	Lead, vitamin A, toxicity
Altered color perception	Carbon monoxide, Cannabis, SD, digitalis
Crack eye (Corneal defects)	Carbon monoxide, cannabis, LSD digitalis
Crack eye (corneal defects)	Cocaine

Temperature changes in poisoning

Hypothermia	Hyperthermia
Alcohol	Cocaine
Barbiturates	Curare
Carbon monoxide	Datura
Opiates	Strychnine

Common radio-opaque poisons

- $CCl4$,
- Chloral hydrate
- Enteric coated tablets
- Heavy metals
- Iodides

- Phenothiazines
- Salicylates

Taste of poisons

Taste	Poison
Bitter	Datura, strychnine
Burning	Acids
Acrid	Calotropis
Sweet	Aconite
Sour	Oxalic acid
Metallic	Copper, iodine
Sweet burning	Carbolic acid
Caustic	Alkali

Diagnostic tests in toxicology

Ferric chloride test	Phenol, salicylates phenothiazines Oxyphenbutazone Phenyl butazone
Dichromate test Hine and Kozelka Test Cavetti's Test	Ethanol
Silver Nitrate Test	ZnP, AlP
Marquis Test	Opium

Denige's Test Husemann's Test	
Lee jones Test	Cyanide, Salicylates
Reinsch Test	Arsenic, Bismuth, Mercury, Antimony
Reinsch Test Marsh's Test Gutzeit Test	Arsenic
Kunkel's Test (Tannic acid Test) Wetzel's Test Hoppe-Seyler's Test	CO
Tensilon or edrophonium challenge Test (To differentiate b/w myasthenia & botulism)	Inject Edrophonium through I. V If paralysis is due to Myasthenia _> Recovery If paralysis is due to Botulism → No recovery
Wenzel's Test Sonenshein's Test	Strychnine

Classification of poisons

I. Corrosives/caustics:

- Strong acids:
  - Mineral or inorganic acids: Sulfuric, nitric, hydrochloric, etc.

  - Organic acids: Carbolic, oxalic, acetic, salicylic, etc.
- Strong alkalies:
  - Hydrates and carbonates of sodium, potassium & Calcium Ammonia, etc

II. Irritants:

- Agricultural
- Inorganic
  - Non-metallic: Phosphorus, halogens, etc.
  - Metallic: Arsenic, Pb, mercury, copper, thallium, zinc, manganese, etc.
- Organic
  - Irritant plants:
- Castor, croton, Abrus precatorius (ratti/gunja), Calotropis (akdo/madar), capsicum (mirch), Plumbago zeylinica (chitra), Plumbago rosea (lal chitra), aloes etc.
  - Bites and stings
  - Snake, scorpion, spider, cantharide, bee, wasp etc.
  - Mechanical → Powdered glass, chopped hair, diamond dust, etc.

III. Neurotoxic

- Cerebral
  - Somniferous: Opium and opiates
  - Inebriants: Alcohol, barbiturates, chlotal hydrate, ether, chloroform, etc.

  - Deliriants: Datura, cannabis, cocaine, Atropa belladonna, hyoscyamus, etc.
  - Psychotropic: Hallucinogens or Psychedelics (LSD, Phencyclidine, Magic mushrooms, Mescaline etc.), Antidepressants (Amphetamine, Tricyclics, MAOI etc,) and Antipsychotics or Neuroleptics
- Spinal
  - Excitatory: Strychnos nux vomica
  - Inhibitory: Gelsemium, etc.
  - Peripheral: Hemlock (conium), Curare etc.

IV. **Cardiac:**

- Antihypertensives
- Anticoagulants
- Cardiotoxic poisons: Nicotine, Nerium odorum, Cerbera thevetia, Cerbera odollam, Digitalis purpurea, aconite, etc.

V. **Asphyxiants:**

- Irrespirable gases: CO, CO2, H2S, cyanogen gas etc.
- Cyanides

VI. **Miscellaneous:**

- Pesticides, Poisonous food, Food poisoning, substances of abuse, pharmaceuticals etc.

CORROSIVES/ CAUSTICS

Corrosives/ caustics 00:00:10

- Corrosives may be

  1.Acids → - cause coagulative necrosis

  (Exception: HF → Liquefactive necrosis)

  - Form eschar
  - Perforation of stomach
  - Acid + Hb → Acid hematin (coffee ground vomitus) → Dark brown
  - No singeing, No red line
  - No blisters (except in formic acid)

  2.Alkalis → - Liquefactive necrosis (LN) (Also, HF)

  - Form fibrous scar
  - Stricture of oesophagus (Surgery may be required)
  - Danger: Alkali > Acids (Invades deep)
  - No singeing, No red line
  - No blisters
- Caustic poison corrodes mucosa because it is hygroscopic in nature.
- Magenstrasse is Stomach Street.

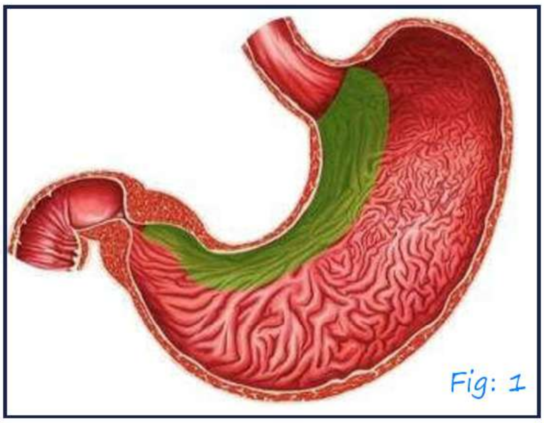


Fig: 1

- Most common site of damage by corrosive in flood filled stomach is lesser curvature.

I. Mineral acids 00:08:50

- Example: H_2SO_4, HNO_3, HCl, Boric acid etc.
- They have only local action

H_2SO_4 (oil of vitriol)

- All tissues become black

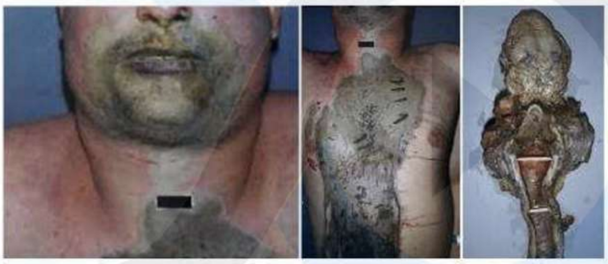


Fig: 2

- Except teeth → it becomes chalky white

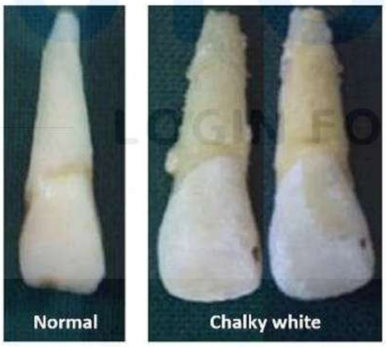


Fig: 3

- Wet blotting paper consistency of stomach is seen in poisoning by sulfuric acid.
- The cause of death in a child with sulphuric acid can be by reflex vocal spasm.

Vitriolage:

- Corrosive substance is thrown onto a victim.
  (MC agent used is H_2SO_4)
- 326A IPC → Voluntary causing grievous hurt by use of acid (10 years to Life imprisonment)
- 326B IPC → Voluntary attempting to throw acid (5-7years)

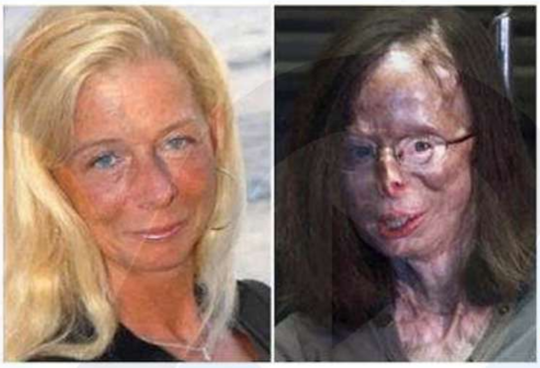


Fig: 4

HCl (Muriatic acid)

- All the tissue become Gray including teeth.

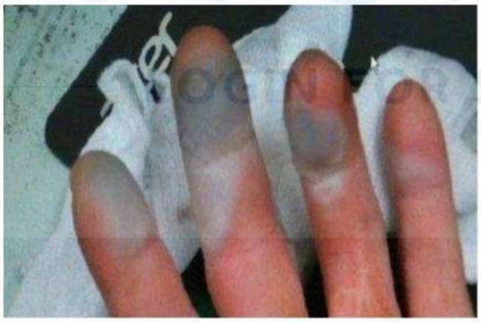


Fig: 5

HNO_3 (Aqua fortis)

- All the tissue become yellow including teeth.

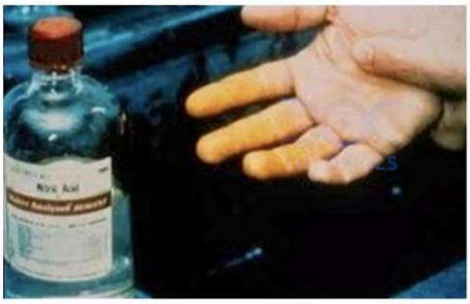


Fig: 6

- Xanthoproteic reaction is seen in Nitric acid.
  - Brown urine is seen in poisoning by nitric acid.
- Stomach wall
- H_2SO_4 → Black
- HNO_3 & HCl → Converts Hb into acid hematin & gets deposited on the stomach wall which converts stomach mucosa into dark brown.
- Perforation of stomach is most common in H_2SO_4.
- Next strongest is HNO_3 but perforation is less common.
- Perforation uncommon in HCl
- In carbolic acid, stomach wall becomes hard & leathery.
- The preferred chemical antidote in mineral acid poisoning is Magnesium oxide.

  (Use of neutralizing agents are controversial)

Hydrofluoric acid (HF)

- It causes severe throbbing pain.
- It causes tissue necrosis and destruction.

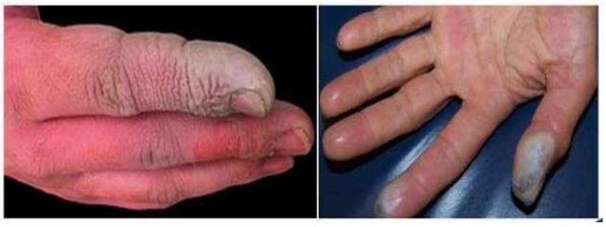


Fig: 7

- Causes Acidosis
- Hypocalcaemia
- Hypomagnesemia
- Hyperkalaemia
- Ca gluconate is an antidote in
  - Fluorides & HF
  - Oxalic acid
  - Ethylene glycol → oxalic acid is metabolic and product.
  - Hyperkalaemia
  - Citrate toxicity
- Citrate toxicity is treated by 10% calcium gluconate.

Boric acid

- It causes erythroderma.

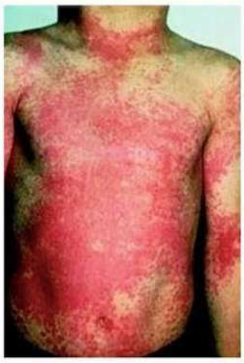


Fig: 8

- Mimics staphylococcal scalded skin syndrome.

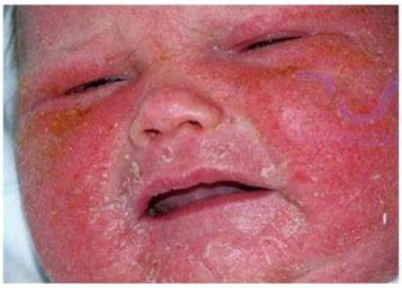


Fig: 9

- It gives rise to boiled lobster appearance.

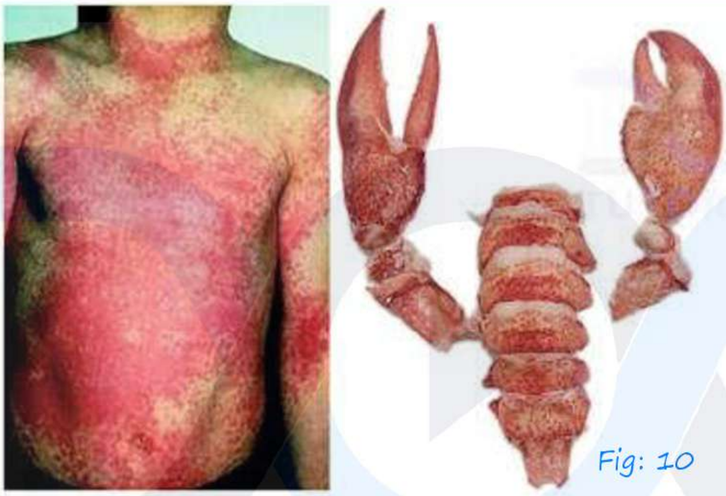


Fig: 10

- The acid that is widely used in leather & rubber industry is formic acid.

II Organic acid 00:22:38

- Both local & systemic action.

Oxalic acid

Salt of Sorrel

Fig: 11

- Excessive consumption of carambola, cabbage, spinach, rhubarb can cause poisoning by oxalic acid.
- Oxalic acid is used in forgeries as an ink remover solution.

  (Forgery - 463 IPC)
- MOA → OA + Ca → oxalate → Hypocalcaemia → tetany

Carpal spasm → Obstetrician's / Accoucheur's hand

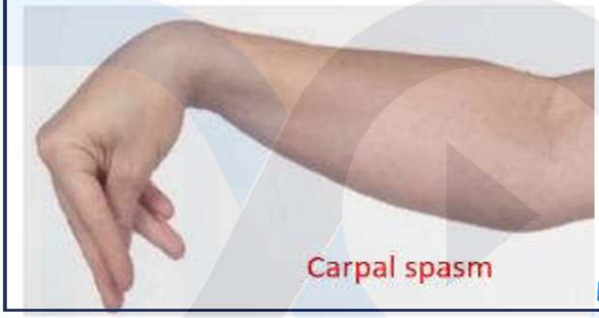


Fig: 12

- Trousseau's sign → Inflate BP cuff to 120 mm of Hg → Carpal spasm
- Chvostek's sign → Tap on facial nerve in front of tragus → Twitching of facial muscles

Urine microscopy

- We see oxalate crystals as
- Monohydrate crystal → Needle / prism shaped.

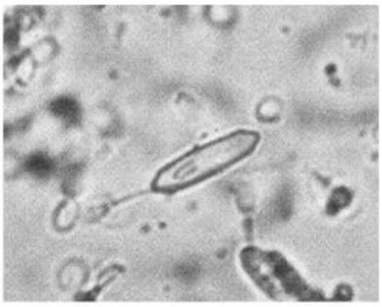


Fig: 13

- Dihydrate crystals → postal envelope /tent shaped.

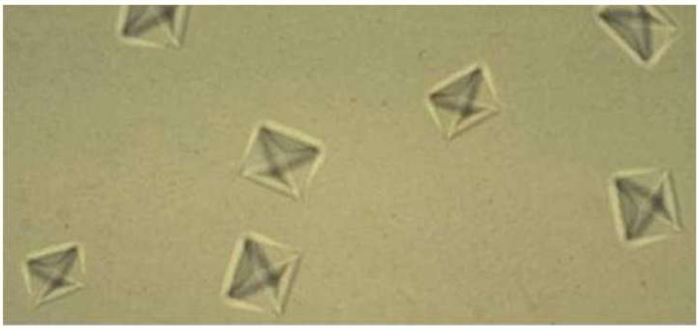


Fig: 14

- Wall scrapings can be used as first aid remedy in poisoning by oxalic acid.

  (Wall scrapings contains C_aCO_3)

- Excessive water intake is contraindicated in oxalic acid poisoning.

Carbolic Acid

- Can be absorbed through skin and mucous membrane.
- Causes pinpoint pupil.
- It is a nephrotoxic poison.
- Hard, thick and leathery stomach → stomach wash is indicated

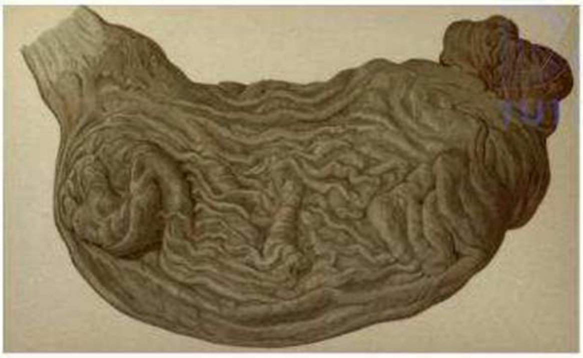


Fig: 15

- Smoky green urine is seen.

Treatment of carbolic acid poisoning includes:

- Repeated lavage should be done.
- Intubation may be required in respiratory compromise.
- Saline containing sodium bicarbonate is given I.V. (Emetics would generally fail due to anaesthetic effect)

Normal saline with NaHco3 I.V – helps in 3 ways

- Combats circulatory collapse.
- Dilutes carbolic acid content of blood.
- Promotes diuresis – increased excretion of carbolic acids.

Phenol marasmus (Chronic poisoning) 00:33:10

- Metabolic end products of hydroquinone and pyrecatechol gets deposited in skin, sclera and cartilage giving rise to Oochronosis.

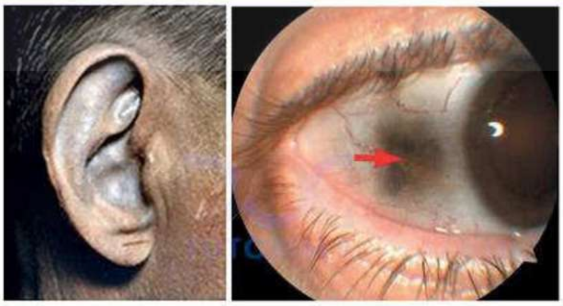


Fig: 16

Extra Edge topics 00:34:12

- Sulphuric acid is the strongest corrosive poison
- Most common agent used for vitriolage is
  - Sulphuric acid
- Alkaline carbonates and bicarbonates are contraindicated as an antidote in poisoning by acids, because
  - It liberates carbon dioxide, which may cause gastric dilatation and sometimes rupture
- In corrosive poisoning,
  - Endoscopy should be performed within 12 hours (Safest during this period)
  - Not later than 24 hours, because risk of perforation increases after this period
- Because of pyloric spasm, acids cannot pass through and collect
  - Causes more injury to pyloric region.
- Delayed poisoning by oxalic acid is characterised by
  - Uraemia
- Carbolic acid is depressant of nervous system,
  - Especially the respiratory centre
- Lye is NaOH
  - Which can produce transmural necrosis of the esophagus almost immediately
  - Esophageal stricture is also common with occasional perforation

AGRICULTURAL POISONS

Insecticides 00:00:19

- Organophosphorus (OP) compounds [OPC]
  - Alkyl phosphates → HETP, TEPP, OMPA, Malathion etc. and
  - Aryl phoshates → Parathion (Follidol), Methyl Parathion (Metacide), Diazinon, (Tik-20), Paraoxon etc.
- Organochlorine (OC) compounds → Endrin, Dieldrin, Aldrin, DDT, Gamaxane, BHC, Lindane, Endosulfan, Toxaphene etc.
- Carbamates → Carbaryl, Aldicarb, Baygon, Aminocarb, Ficam and Propoxur etc.
- Plant products → Pyrethrins, Rotenone and Nicotine
  - Pyrethrins are active extracts of the Chrysanthemum plant,
  - Pyrethroids are synthetic analogues

Organophosphorus compounds 00:01:05

Organophosphorus (OP) compounds

- They are irreversible ChE inhibitors.
- Classified as Alkyl & aryl phosphates.
- Malathion is alkyl phosphate.
- ChE

  - True/RBC ChE → estimation is more specific but difficult to assay.
  - Pseudo/plasma ChE → More sensitive, easy to assay and more commonly done.
- The clinical effects of OP toxicity is due to inhibition of RBC ChE.
- Normal level of ChE is 4,000 to 11,000 IU
  - 20-50% of normal → mild poisoning
  - 10-20% of normal → moderate poisoning
  - <10% of normal → severe poisoning
- OP increases the secretions of all glands.
  - It increases the secretion in bronchial tree causing wheezing and mimics asthma.
  - Increases secretion in lacrimal glands thereby increasing lacrimation → crocodile tears
  - Sometimes the tears may be red in colour known as chromolachryorrhoea/chromogenic tears.
  - In kidney, it causes increased urination causing incontinence of urine.
  - Miosis (but not present in all cases)
  - Hypotension & bradycardia (muscarinic) > hypertension & tachycardia (nicotinic)

Signs & symptoms

- S – Salivations, sweating
- L – Lacrimation
- U – Urination
- D – Defecation

- G – Gastrointestinal cramping
- E – Emesis
  - OP poisoning causes fasciculations
- In opioid – there is miosis, but increased sweating only
- In phencyclidines → mydriasis, dry skin, tachycardia
- In barbiturates → Miosis, weak rapid pulse
- In cocaine → Mydriasis, hypertension, tachycardia

OP Poisoning 00:11:10

- OP compounds (poisoning) causes
  a. Intermediate syndrome (IMS)
    - May be seen in 1-4 days after poisoning.
    - There is motor cranial nerve palsies, weakness of neck flexors & proximal limb muscle.

  b. Delayed syndrome/OPIDPN
    - May be seen 1-4weeks after poisoning.
    - There is nerve demyelination that give rise to delay polyneuropathy. This gives rise to flaccid weakness & atrophy of distal limb muscles, or spasticity or ataxia.
- There is no specific treatment for IMS & OPIDPN.
- Jamaica ginger (jake) paralysis is due to contamination of ethanol with organophosphorus (Triorthocresyl phosphate – TOCP)
- Cause of death in OP poisoning is due to respiratory failure.

- Specific treatment for OP poisoning is atropine (Role of oximes is controversial).
- Atropine is stopped in OP poisoning, when tracheo-bronchial tree is cleared.
- Atropine is contraindicated in cyanosis due to danger of ventricular fibrillation.

Carbamates 00:19:03

- Example: Baygon
- It is reversible ChE inhibitors .
- Signs & symptoms are same as OP, but much less pronounced (Hydrolyse spontaneously form ChE within 24-48hours).
- Don't penetrate BBB; thus, CNS toxicity is minimal.
- Bradycardia/tachycardia & miosis/mydriasis.
- Can also lead to IMS (Intermediate syndrome).
- DOC is atropine.
- Oximes are contraindicated.
- MOA of carbamate poisoning is reversible carbamylation.

Organochlorine (OC) compounds 00:23:09

- They interfere with nerve impulse transmission.
- Example: DDT, Gammexane, Endrin etc.
- Endrin is known as plant penicillin.
- No specific antidote
- When ingested, endrin is stored mostly in fatty tissue.

- Insecticides of plant origin → Pyrethrine, nicotine & rotenone

Paraquat 00:25:40

- It causes acute tubular necrosis.

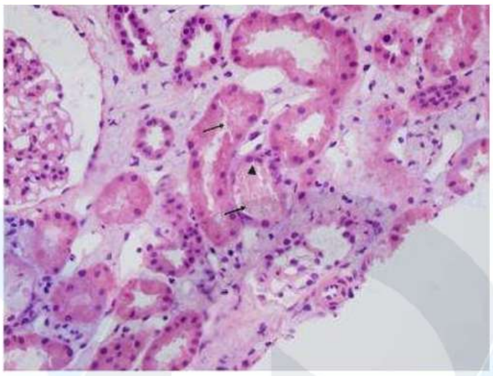


Fig: 1

- Causes centrilobular hepatic necrosis.

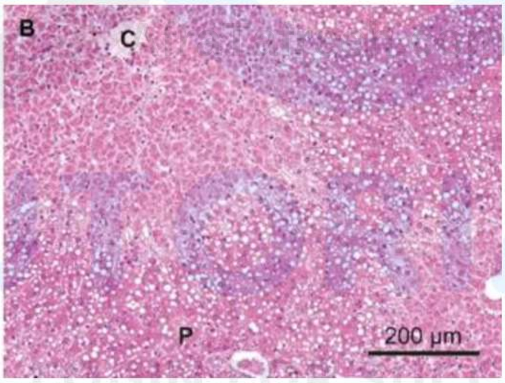


Fig: 2

- Causes pulmonary fibrosis.

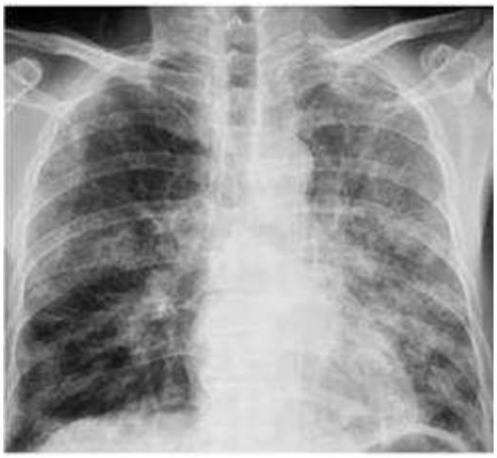


Fig: 3

- Causes oral ulcer.

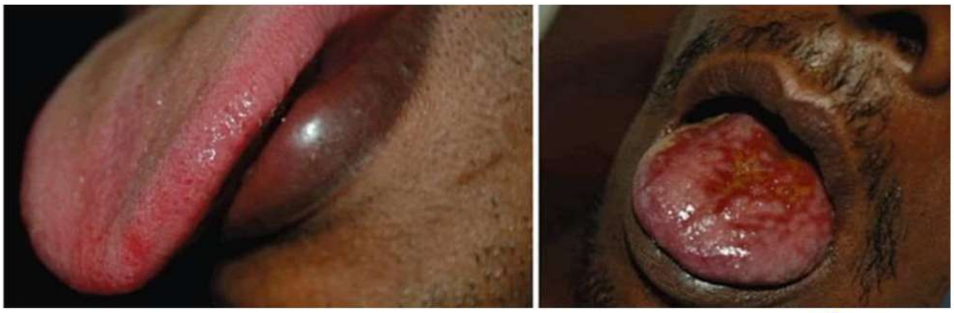


Fig: 4

- Pupils are normal
- Causes hypothermia

Aluminium phosphide (AlP) 00:27:17

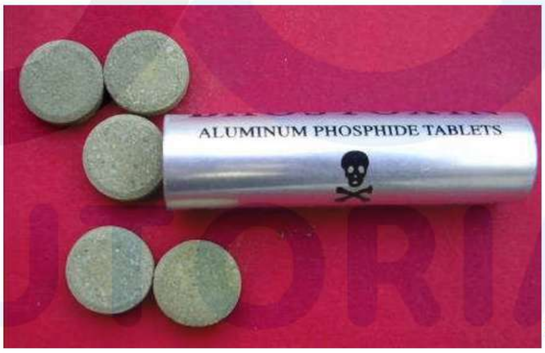

ALUMINUM PHOSPHIDE TABLETS

Fig: 5

- It causes oesophageal stricture.

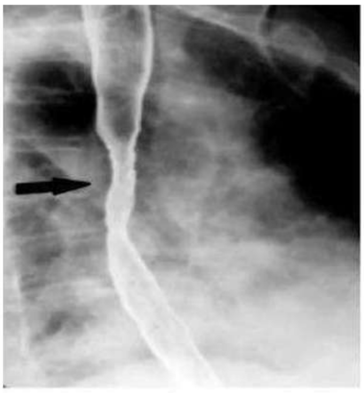


Fig: 6

- Causes sub-endocardial haemorrhage.

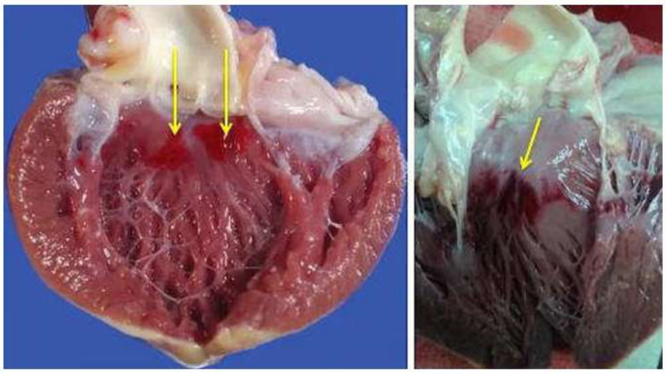


Fig: 7

- AlP + HCL (in stomach) → phosphine gas
  - It affects the lungs, liver & heart (Not kidneys)
- Liver shows centrizonal hemorrhagic necrosis
- Stomach wash and water is contraindicated as water liberates phosphine gas with AlP
- It inhibits cytochrome c oxidase.
- Treatment of choice is $MgSO_4$. There is no specific antidote
- Gastric lavage turns black in presence of silver nitrate in celphos poisoning (AlP).
- Barium carbonate → cardiac arrythmia due to hypokalemia.

DOCT TUTORIALS
LOGIN FOR SUCCESS

INORGANIC IRRITANTS

Non-Metallic Poisons 00:00:21

Phosphorous (P)

1.Red phosphorus → Nontoxic

Fig: 1

2.Yellow/White Phosphorus → Highly toxic

Fig: 2

- It is luminous, waxy, translucent poison with phosphorescence action.
- It is preserved under water.
- It is known as Diwali poison.

  → Diwali poisons are → P, Hg, Antimony, Arsenic, Strontium (P>Hg)
- It causes smoky stool syndrome.
- It is a hepatotoxic poison.

- Initially liver gets enlarged known as necrobiosis.
- Later it is totally shrunken known as acute yellow atrophy.
- It causes hypoprothrombinemia. This causes bleeding diathesis & epistaxis.

- It causes subendocardial (Sheehan's) hemorrhage (Also seen in Arsenic, Antimony, A&P, Viper bite).

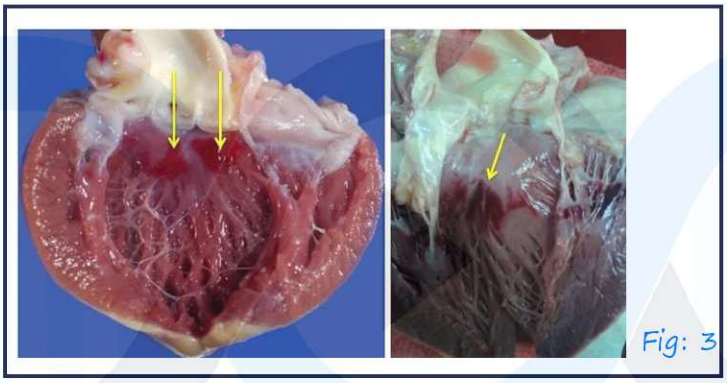


Fig: 3

- It causes priapism (Also seen in cantharides & scorpion).
- Yellow phosphorous causes asterixis.

Chronic poisoning

- Inhalation of fumes (P pentoxide) leads to tooth ache, swelling & loosening of teeth and further leads to osteomyelitis, sequestration & necrosis of mandible with multiple sinus, oozing garlic smelling pus. This condition is known as phossy/Glass jaw.
- In phosphorus, there is dark brown postmortem staining and garlic odour in stomach.

Iodine 00:07:20

- It causes strangury. (Also seen in cantharides)
- Brown urine
- Antidote → Na thiosulphate
- Iodism – Chronic poisoning by iodine
- Iodism gives rise to the condition Ioderma → erythematous patch of skin, urticaria, etc.

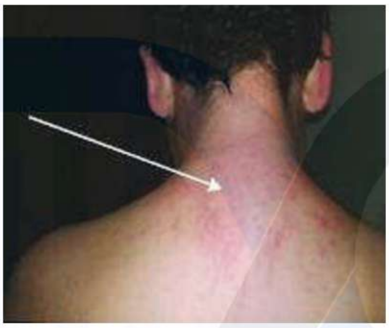


Fig: 4

- It gives rise to parotid swelling → mimics mumps.
- It also mimics acne (even bromide mimics acne).

Metallic Poisons 00:09:14

- Metals per se is not poisons; but only the compounds are poisonous.

  Exception: LEAD

Lead 00:10:00

- It is the most common source of chronic heavy metal poisoning (2nd is Arsenic)
- Lead sulphide is the least toxic compound of lead.

- Salt of Saturn is lead acetate. It is also known as sugar of lead.

Fig: 5

- Vermilion or sindhoor is made up of lead tetroxide.
- Most common route of absorption of lead in case of industrial inorganic lead poisoning is by inhalation
  - Absorption of Pb by oral route is less efficient
  - (10-15% of total absorbed Pb comes via this route than by inhalation (40-50%)
- Plumbism is chronic lead poisoning (also known as saturnism).

- Earlitest sign of plumbism is circumoral/facial pallor.
- Blood:
  - Pb inhibits heme synthesis through inhibition of ALA dehydratase.
  - Initially polycythemia, later anemia.
  - Reticulocytosis, poikilocytosis, Anisocytosis
  - Cabot's ring - Inclusion body in RBCs
  - Basophilic stippling (Punctuate basophilia)

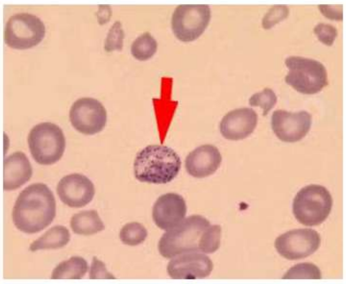


Fig: 6

  - Basophilic stippling is seen in zinc, arsenic, lead.
  - Basophilic stippling is due to the inhibition of pyrimidine-5 nucleotidase
- Eosinophilia is more consistent finding than punctate basophilia.
- Burtonian line/Burton's line
- Bluish/bluish black line in the gums at the junction with teeth (in 50-70% of cases).

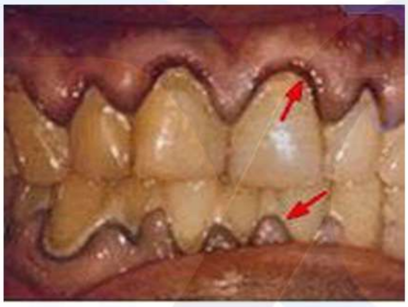


Fig: 7

- Pb + H_2S (liberated from putrefied food in caries) → Pbs
- Seen in poisoning by
  - Pb
  - Bismuth
  - Iron
  - Silver
  - Mercury
  - Copper (Green in colour, known as Clapton's lines)
- Lead line → Lead osteopathy
  - Increased metaphyseal density
  - Due to deposition of Ca.

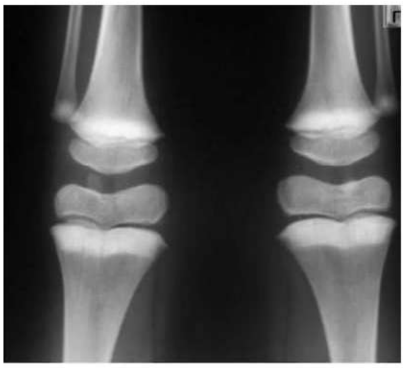


Fig: 8

- Retinal stippling
  - Deposition of Pb in retina

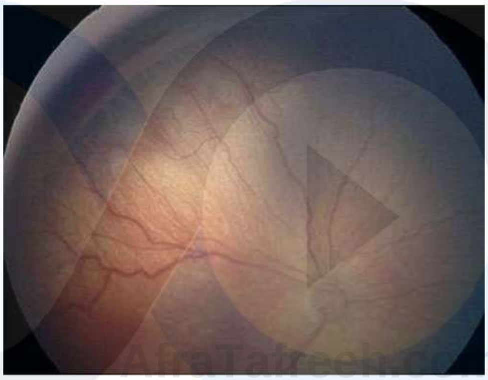


Fig: 9

- Lead palsy
  - Seen in about 10% of cases.
  - Affects radial nerve → wrist drop & ant. peroneal nerve → foot drop.

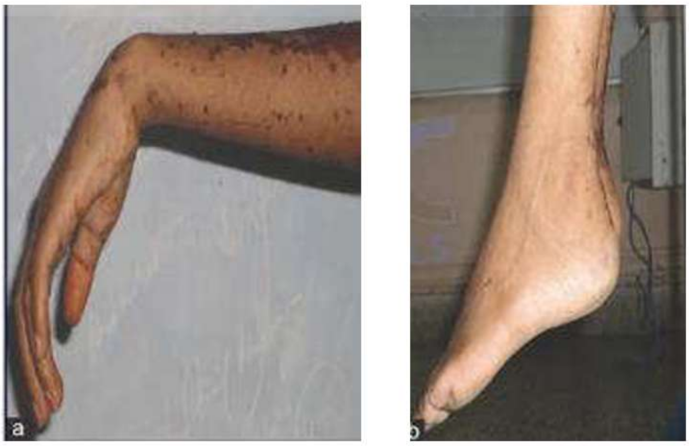


Fig: 10

- Causes infertility in both sexes.
- Azotemia (increased urea & creatinine)
- Saturnine gout.

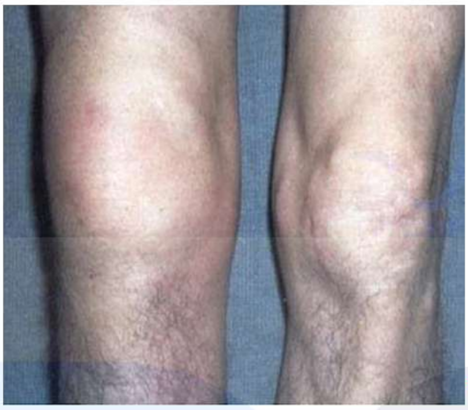


Fig: 11

- Lead encephalopathy
  - Blood Pb level > 100µg/dl
  - Most common in children
  - Due to tetraethyl Pb
- Chronic arsenic & lead poisoning cause → Chronic encephalopathy with Delirium, Hallucinations, Disorientations, Agitations & Confabulations → resembling Korsakoff's syndrome
- Late features
  - Colicky (relieved on pressure)
  - Constipation (Dry belly ache)
- Least common complication of lead poisoning in adults is peripheral neuropathy.
- Key test for diagnosis of lead poisoning is blood lead level. (>5µg/dl is unsafe in children).
- Treatment → Pb poisoning

- In mild poisoning → DMSA
- In severe poisoning
  - i. BAL is given to chelate the lead in the brain.
  - ii. DMSA/Ca–EDTA is given to act in the body.

Arsenic 00:25:43

- Also known as inheritance powder/Le poudre de succession.

Fig: 12

- Most common source of acute heavy metal poisoning.
- Arsenic is a metalloid, i.e., it has properties of both metal as well as non-metals.
- Most poisonous compound of arsenic is arsine(gas).
- Arsenious trioxide → Most poisonous substance

Acute poisoning

- Signs and symptoms mimic cholera because it mimics acute gastroenteritis.

Trait	Arsenic poisoning	Cholera
Throat pain	Before vomiting	After vomiting
Purging	After vomiting	Before vomiting
Stools	Initial dark & bloody, later rice watery	Rice watery
Tenesmus & anal irritation	Present	Absent
Voice	Normal	Rough and whistling
Conjunctive	Inflamed	Not inflamed

- Red velvety stomach is seen in arsenic poisoning.
- Flea bitten appearance in stomach mucosa is seen

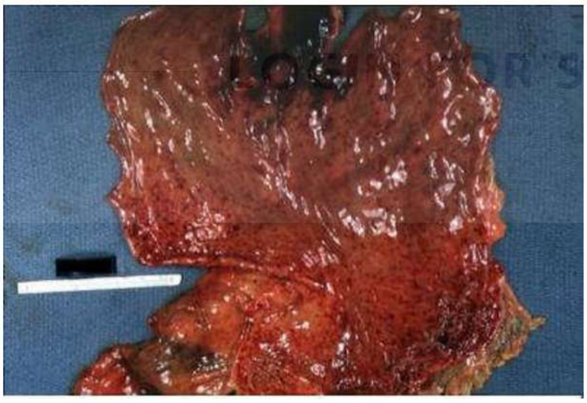


Fig: 13

- Subendocardial hemorrhage is seen

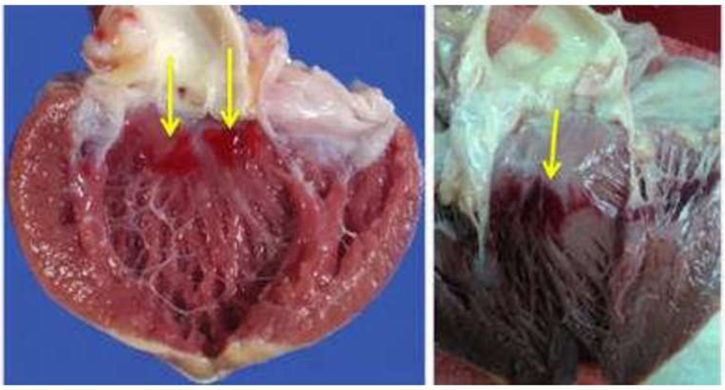


Fig: 14

- Arsenic causes glove & stocking mixed neuropathy – sensory predominant.
- Acute tubular necrosis

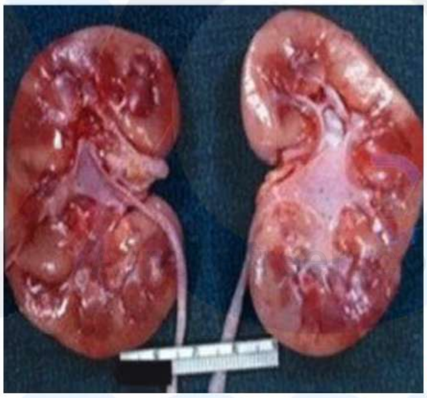


Fig: 15

- Acute yellow fatty liver is seen.

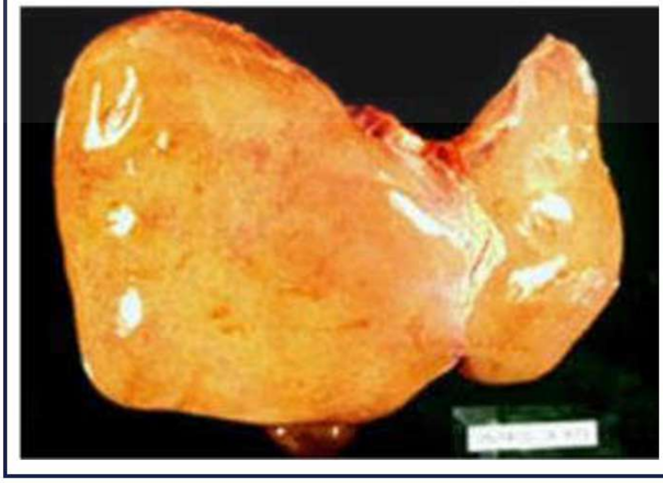


Fig: 16

Chronic Poisoning

- Earliest sign is emaciation.
- Catarrhal changes – Rhinitis, lacrimation, conjunctivitis, Bronchial catarrh

Rhinitis
Lacrimation
Conjunctivitis

Fig: 17

- Hyperpigmentation of palms and soles is seen. It mimics Addison's disease.
- Hyperkeratosis of palm and soles.

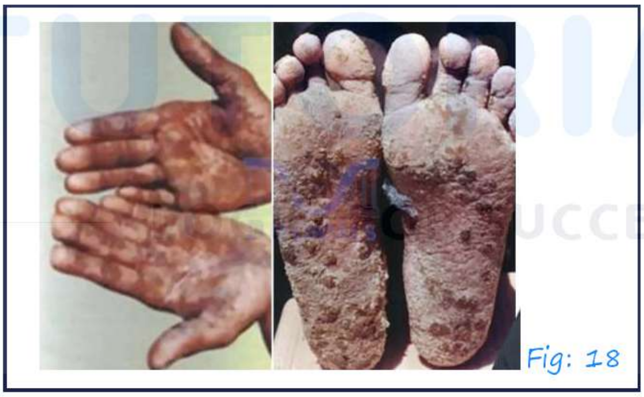


Fig: 18

- Rashes resembling fading measles is seen.
- Rain drop brown pigmentation is seen.

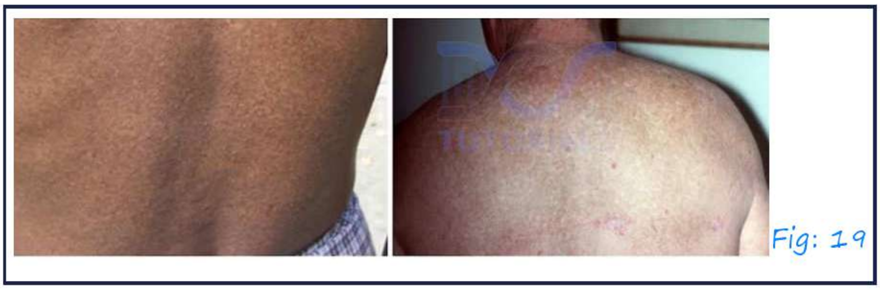


Fig: 19

- Black foot disease is caused. It is a gangrenous change.

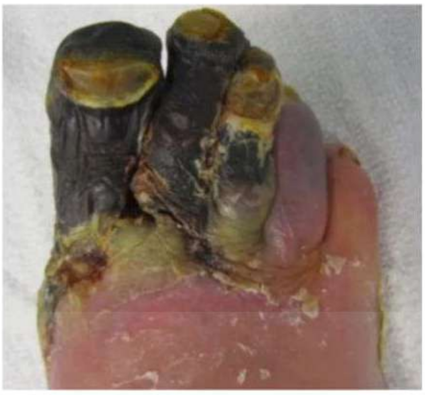


Fig: 20

- Aldrich-Mee's lines (leukonychia) is seen.
  - Multiple, transverse parallel white lines in the nails.
  - Takes about 30 days after first exposure.
  - Also seen in thallium poisoning.

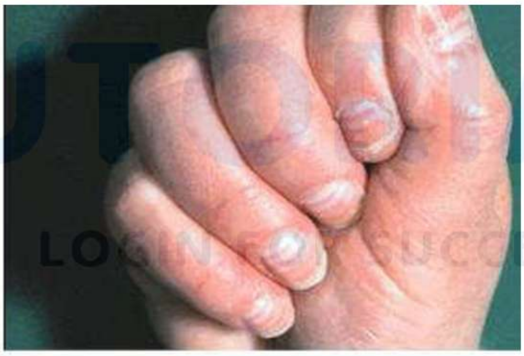
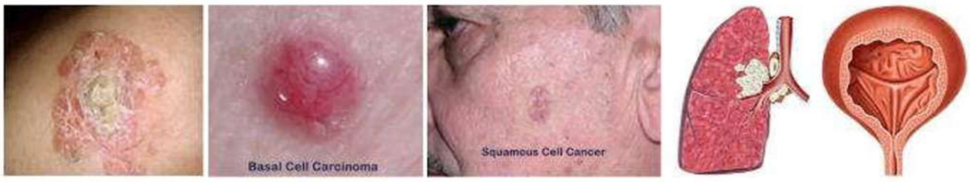


Fig: 21

- Cancer
  - A precancerous lesion called Bowen's disease.
  - Basal cell carcinoma
  - Small cell carcinoma
  - Ca lung
  - Ca bladder



Bowen's disease BCC SCC Ca Lung Ca Bladder

Fig: 22

- Golden hair discoloration (Also seen in copper & cadmium)
- Fatal dose → 200-300mg
- Definitive diagnosis → 24-hour urinary arsenic [>100μg/day]
- Best method to detect arsenic is AAS (Atomic Absorption Spectroscopy).
- Marsh, Reinsch & Gutzeit tests were used for the detection of arsenic; but are obsolete now.
- In acute arsenic poisoning, greatest amount is found in liver, followed by kidney and spleen
- In chronic poisoning, greatest amount is found in hair & nails.
- Arsenic can be detected in hair, long time after death.
- In acute poisoning, maximum accumulation of arsenic is seen in liver.
- In case of death due to acute arsenic poisoning, viscera preserved is Liver, stomach, blood, kidneys, intestine, urine
- Arsenic can also be detected in burnt bones.
- Cadaveric rigidity lasts longer in Arsenic poisoning.

- Arsenophagists are the people, who take arsenic daily as tonic or as an aphrodisiac and they acquire a tolerance of up to 0.3gm or more in one dose.

Copper 00:43:56

- $CuSo_4$ → Blue vitriol
- copper subacetate → Verdigris → Bluish green deposition on Cu vessels.
- Resposnible for food poisoning by cooking food in Cu vessels

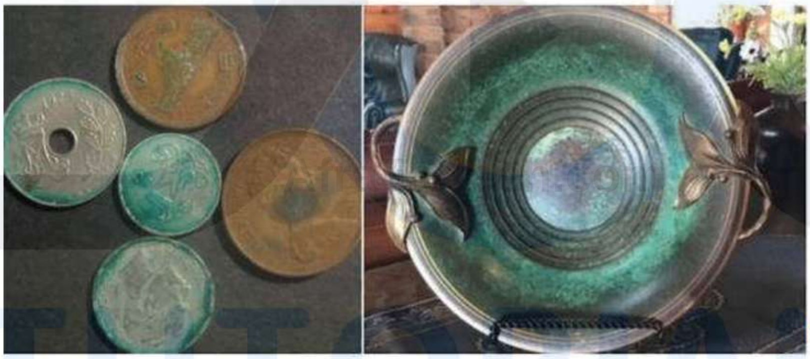


Fig: 23

- The colour of vomited matter in copper poisoning is blue or green.
- The frothy discharge is also bluish green.
- Bluish discoloration of stomach mucosa is seen in poisoning by
  - Copper sulphate
  - Sodium amytal
  - Dextropropoxyphene

- Discolouration of hair by water contamination is seen in copper poisoning (Algicidal Cu compounds in swimming pool).
- Acute copper sulphate poisoning manifests with hemolysis.
- Clapton's lines are seen.

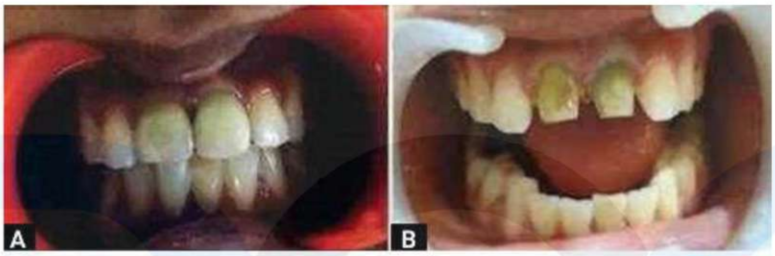


Fig: 23

- Ptyalism (Also seen in Hg, but Cu>Hg)
- Chalcosis → deposition of copper in the tissue.
- Kayser Fleischer ring → deposition of copper in the cornea is seen.

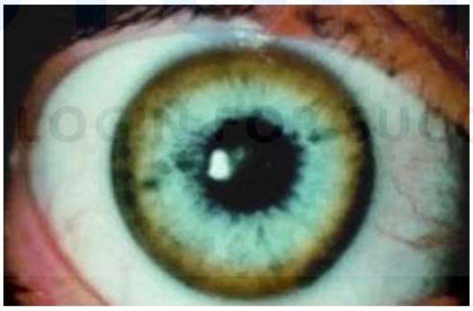


Fig: 24

- Vineyard sprayer's lung disease is caused by blue vitriol. Here, the person may suffer from interstitial pulmonary fibrosis & histiocytic granuloma.

Mercury 00:59:50

- Elemental mercury is not poisonous but vapours of mercury are poisonous.

  Methylmercury

  - It is the most toxic compound of Hg.
  - It is responsible for Minamata bay disease. (through fishes)
  - Causes Hunter Russel syndrome.
- **Mercuric chloride or corrosive sublimate**
  - MC cause of acute poisoning (Amongst different forms of mercury)
- **Mercuric sulphide**
  - Used as vermilion or sindhoor
- 'Pharaoh's serpent' contains mercury thiocyanate

Fig: 25

- Mercurialism is caused by I.V injection of Hg.

  It gives rise to thrombophlebitis, granuloma formation & pulmonary embolism
- Acrodynia or Pink/Swift's/Selter's/Feer's disease
  - Painful, parasthetic, peeling, perspiring, pink & puffy hands and feet in children.

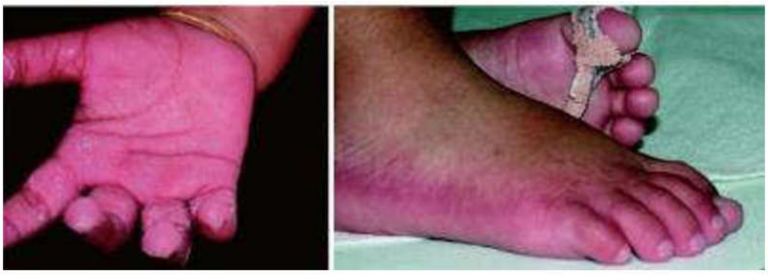


Fig: 26

- Pink urine
- Hydrargyrism → chronic mercury poisoning
  - Earliest sign → Brown malt reflex/Mercuria lentis.

    It is the deposition of Hg in ant. lens capsule

    Diagnosis is done by slit lamp examination.
- Tremors in Hg poisoning → shaking palsy → coarse & intentional

  There are three types of tremors
  - Danbury tremors → Mild
  - Hatter's/Glass blower's shakes → Moderate
  - Concussio/Tetanus mercurialis → Severe
- Erethism
  - Mad hatter's disease
  - Psychiatric manifestation especially insomnia, inappropriate shyness and irritability.
- Ptyalism
- Classical triad of chronic mercury poisoning is
  - Gingivitis, Stomatitis, Salivation
  - Tremors

- Neuro- psychiatric manifestations

- Chronic mercury poisoning causes membranous colitis that mimics diphtheritic colitis.

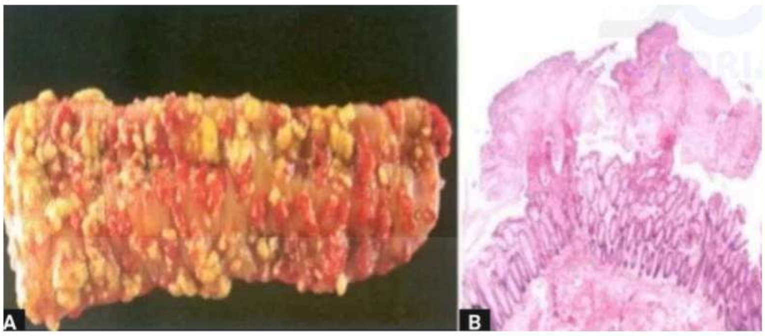


Fig: 27

- Mercury causes muscular pain & proximal convoluted tubule (PCT) necrosis.
- Mercury poisoning mimics Kawasaki disease.
  - Strawberry tongue
  - Skin rashes like scarlet fewer.

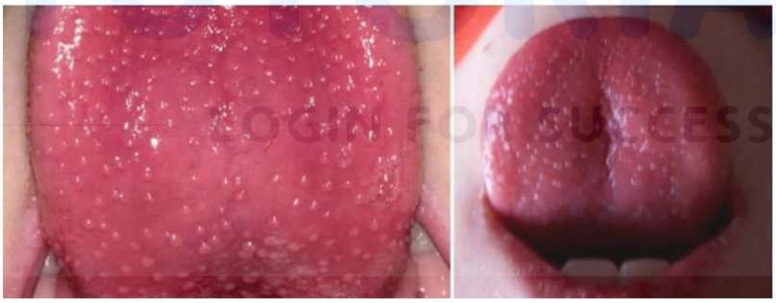


Fig: 28

Fig: 29

- Chronic mercury poisoning also mimics pheochromocytoma.

Treatment

- Drug of choice → BAL
- BAL + penicillamine is a contraindication because it forms a toxic compound
- EDTA is also contraindicated as it is nephrotoxic.
- No chelator for methyl mercury or ethyl mercury is approved by the FDA; DMSA is most frequently used for severe methyl mercury poisoning.

Thallium 01:02:30

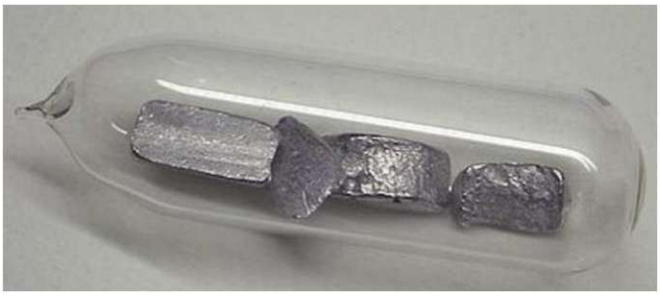


Fig: 30

- Thallium triad

  - Alopecia
  - Butterfly rashes
  - Glove & stocking peripheral neuropathy

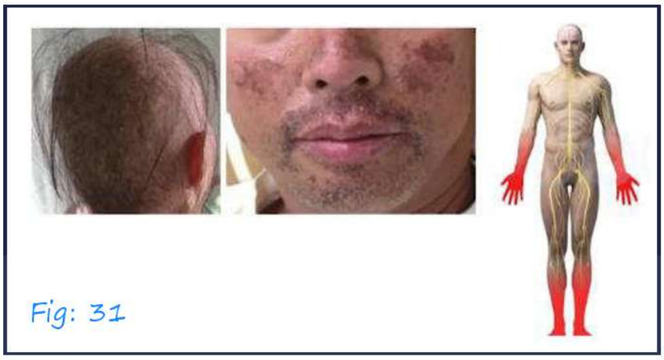


Fig: 31

- Thallium mimics GB syndrome
- Thallium also mimics porphyria
- There is loss of outer 1/3rd of eye brow.
- Mee's lines are seen.

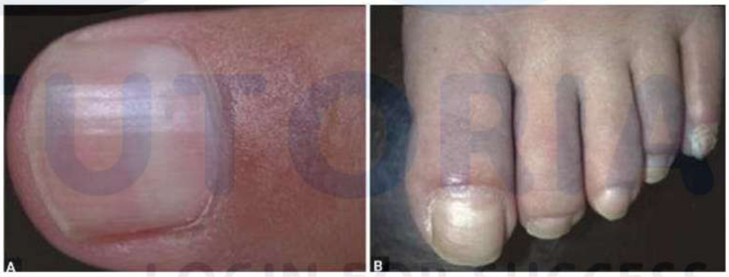


Fig: 32

- Antidote for thallium poisoning is potassium ferric hexacyanoferrate (Prussian blue).

Silver 01:05:17

- Chronic silver poisoning is known as Argyria.
  - It gives rise to grey-black pigmentation to skin and mucous membrane.

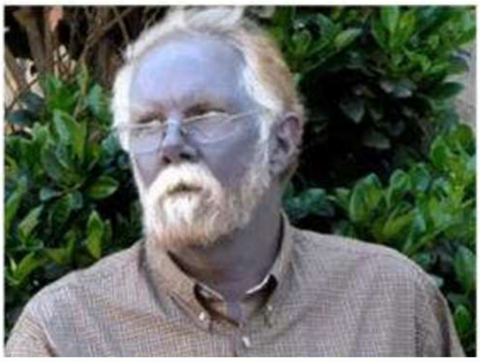


Fig: 33

- It gives blue-ray pigmentation of nail.

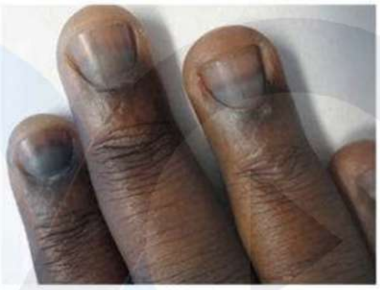


Fig: 34

- Inhalation of fumes while melting metals is known as metal fume fever. It causes fever, chills & malaise & mimics malaria.
- Melting flouropolymers gives rise to polymer fume fever (Meat wrapper's asthma). It causes fever, chills, malaise & wheezing
- Metal fume fever is also known as
  - Monday fever
  - Foundry fever
  - Brass chills
  - Brazier chills
  - Smelter shakes.

- Metal fume fever is common in chronic poisoning with zinc.
- In cadmium poisoning, there is
  - Proteinuria
  - Painful bone lesions
  - Golden yellow staining of teeth.
- Ouch ouch disease is seen in case of Cadmium.
- Cardiomyopathy may be caused by chronic poisoning by cobalt.
- Manganese poisoning is known to give rise to parkinsonism like symptoms. It may also cause manganese madness (psychiatric manifestations) and also it may cause cerebral neurotoxic symptoms known as Angurugu syndrome.
- Dialysis dementia syndrome is seen in Aluminium poisoning.
- Poisoning by selenium causes blind staggers alkali disease in livestock.

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TUTORIALS
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Extra edge topics 01:11:22

Phosphorous

- Phosphorus is a protoplasmic poison
- The tip of the matchstick contains Potassium Chlorate and Antimony Sulphide and the side of the matchbox contains Red Phosphorous and powdered glass

- Gastric lavage using 1:5000 solution of potassium permanganate oxidises phosphorus into phosphoric acid and phosphates, which are harmless.
- Vitamin K is useful in treatment the treatment of Phosphorus poisoning
- Oil and fats should be avoided, as it increases the absorption of Phosphorous

Iodine

- Poisoning is treated with Stomach wash with warm water containing soluble starch and albumin or 5% solution of sodium thiosulphate (It reduces free iodine to non- toxic Iodides).

Arsenic

- The most toxic form of arsenic is arsine gas (Inhalation causes hemolysis)
- Other than Arsine, the most poisonous compound of Arsenic is Arsenious Trioxide (Sankhya or Somalkar)
- Copper acetoarsenite is Paris/Emerald green; Copper arsenite is Scheele's green
- When acute arsenic poisoning is suspected, an X-ray of the abdomen may reveal ingested arsenic, which is radiopaque
- Napolean Bonaparte was killed by using Arsenic
- Its deposition in hair may begin in 15 days after administration

- Arsenic is found in the muscles for days; in the bones, and
- in the keratin tissues – hair, nails and skin for years

lead (PB)

- Tetra ethyl lead was used as anti-knocking agent in petrol (Now banned)
- The largest proportion of absorbed lead is incorporated into the skeleton,
  - which contains >90% of the body's total lead burden
- Lead blocks the conversion of δ-aminolaevulinic acid to porphobilinogen
  - by blocking the enzyme ALA dehydratase
  - This leads to an increase in δ-aminolaevulinic acid in blood and urine
- Lead also inhibits ferro chelatase,
  - which results in elevated free erythrocyte protoporphyrin (FEP) levels

DOC TUTORIALS
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Diagnosis of chronic lead poisoning:

- Blood lead level: >20µg/100ml
- Erythrocyte Protoporphyrin (EP): >35µgm/100 ml
- Free Erythrocyte Protoporphyrin (FEP): >70µmol/100 mol heme

- Increased **A**minolevulinic acid, **C**oproporphyrin & **P**rotoporphyrin **(ACP)** in urine
- Urinary lead: >150µg/L

Manganese

- It may cause
  - Parkinsonism like symptoms
  - Angurugu syndrome
- Neurological disease characterised by
  - upper motor neuron & cerebellar signs, and
  - oculomotor symptoms
- Manganese Madness
- Speech disorders, hallucinations and compulsive behaviour

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ORGANIC IRRITANTS

Plant irritants 00:00:13

Toxalbumin

- There are 3 toxalbumins derived from plants.

  a. Ricin → used as biological warfare agent.

  b. Crotin

  c. Abrin

  - All these are toxic proteins, which blocks protein synthesis through inhibition of RNA polymerase and cause haemolysis.

Ricinus communis 00:01:12

Castor plant Fig: 1

Fig: 2

TUTORIALS LOGIC TO SUCCESS

- Active principle → Ricin
- Ricin is present only in press cake, not in oil.
- Fatal dose: 5 seeds

Croton tiglium 00:02:58

Fig: 3

- Active principle → crotin & crotonoside
- Both press cake and oil contain crotin.
- Fatal dose of croton oil is 20 drops → 4-5 seeds/1-2ml of oil

Abrus precatorius 00:04:27

- Crab's eye, ratti, gunja, gunchi

Fig: 4

Fig: 5

- Active principle → abrin
- It also contains abrine, abralin & abric acid

- Fatal dose: 2 seeds
- Paste made from decorticated abrus alone or mixed with datura, opium, glass powder and onion, is shaped into sharp needle & dried under sun → known as sui/sutari/sin needle. This is pricked into the animal. The signs are similar to viperine snake bite (haemolysis takes place).

Calotropis/Madar plant 00:08:15

Fig: 6

- The twig is used as an abortion stick.
- Madar juice is used
  - As an abortifacient
  - To produce artificial conjunctivitis
  - To produce artificial bruise (occasionally)
  - For vitriolage

TUTORIALS
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Semicarpus anacardium 00:09:43

Fig: 7

- Aka, Bhilwa, marking nut tree
- Active principles → semecarpol & bhilawanol
- Marking nut juice is used
  - To produce artificial bruise
  - For vitriolage
  - As an abortifacient
  - To produce artificial conjunctivitis

Plumbago Rosea & Plumbago Zeylanica 00:11:54

Lal chitra/Red leadwort
Chitra/White leadwort

Fig: 8

- Active principles: Plumbagin & plumbagic acid
- Plumbago juice is used
  - As an abortifacient
  - To produce artificial bruise

Capsicum annum (chilli) 00:12:57

Fig: 9

- Active principle → capsaicin and capsicin.
- Hunan hand → a contact dermatitis with burning

Bites & stings 00:13:53

Snakes

- Ophitoxemia means snake envenomation.

Elapids

- Common cobra
- Common krait (most common)
  - They are neurotoxic
  - Death is by respiratory failure

Vipers

- Russel's viper
- Saw scaled viper
  - They are vasculotoxic.
  - Death is by circulatory failure.

Sea snakes

- They are musculotoxic.
- Death is by respiratory failure.

Ophiophagus Hannah (King cobra) 00:15:58

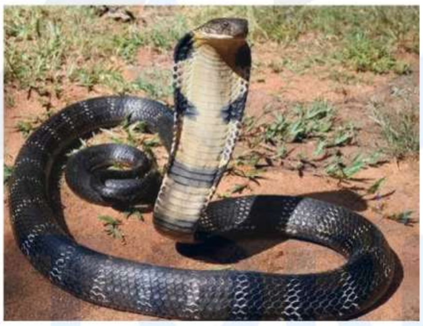


Fig: 10

Naja naja (common cobra) 00:16:45

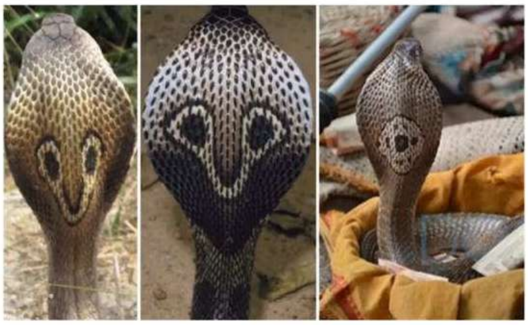


Fig: 11

- Spectacle or monocle mark on the hood.

- It has a hood.
- 3rd supralabial touches both eye & nostril.

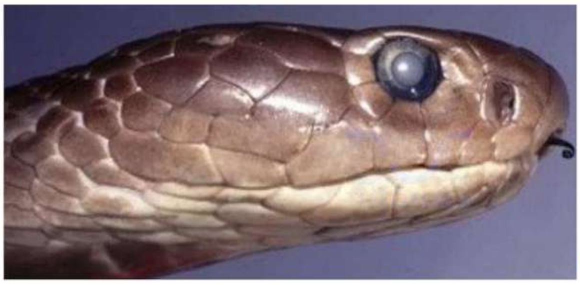


Fig: 12

Bungarus caeruleus (common krait) 00:19:32

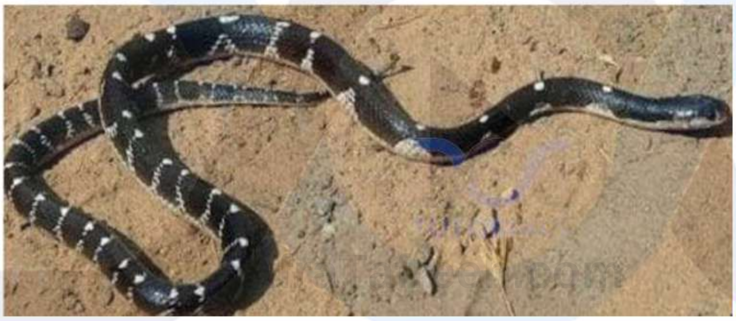


Fig: 13

- Thin stirpes on the body (not always).
- Central row of hexagonal scales on the dorsum.
- 4th infra-labial is largest.

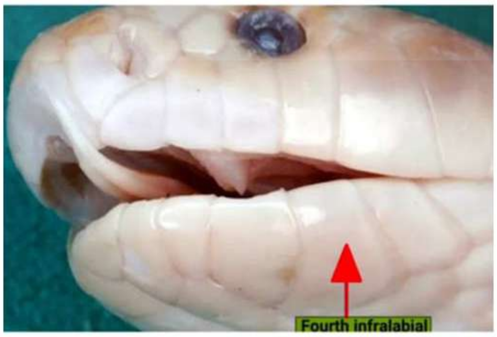


Fig: 14

Bungarus fasciatus (banded krait) 00:27:39

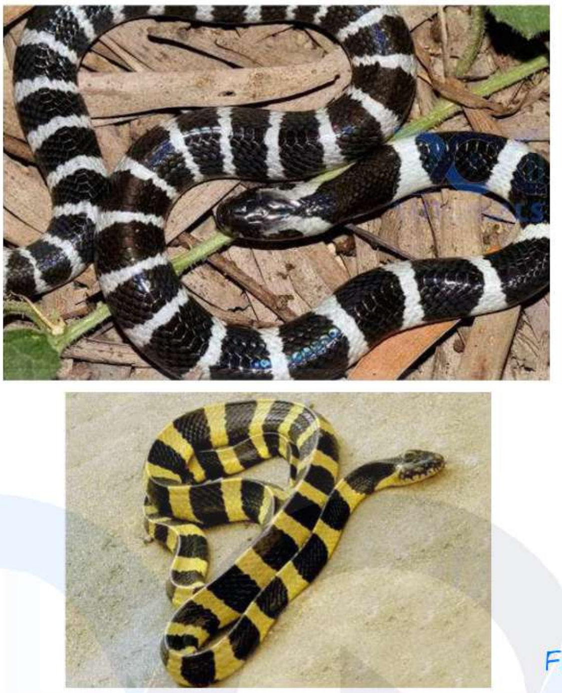


Fig: 15

- It has thick bands (white or yellow) on the body.

Daboia russelii (Russel's viper)

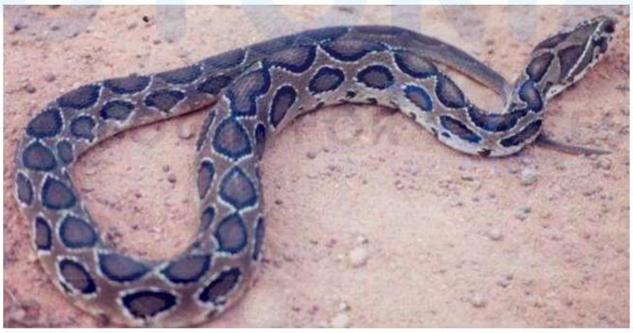


Fig: 16

- Triangular head with narrow neck.
- Three rows of diamond shaped marks on the body.

Echis carinatus (saw-scaled viper)

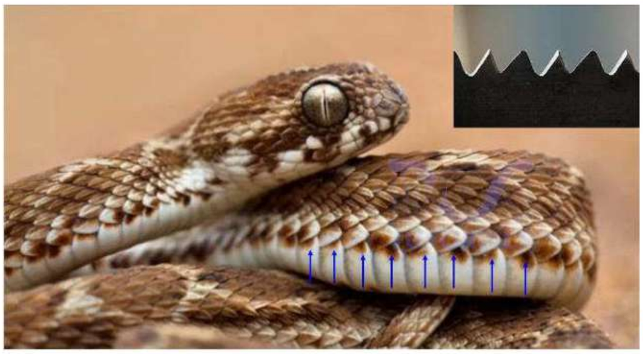


Fig: 17

Crotalinae (pit viper)

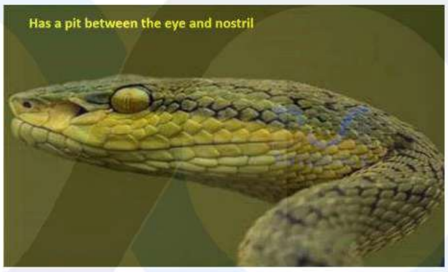

Has a pit between the eye and nostril

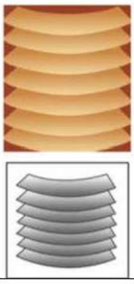
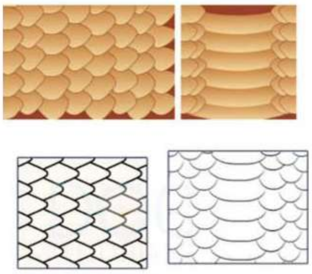
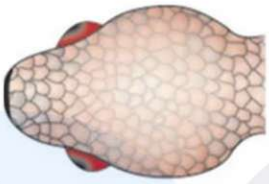
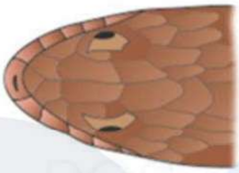
Fig: 18

Pythonidae (python)

Fig: 19

Indian rate snake – Ptyas mucosa

Fig: 20

Trait	Poisonous	Non-poisonous
Belly scales	Cover the entire breadth 	Does not cover the entire breadth 
Head scales	Small 	Large 
Teeth	2 long fangs 	Multiple small teeth
Tail	Compressed 	Not much compressed
Habits	Nocturnal	Not so

- Stability of venom is depending on disulphate bond.
- Most potent venom is that of jelly fish.

Jelly fish > Scorpion > Common krait

- Earliest neurological sign in elapids bite is ptosis.
- The most useful bed site test for hemotoxic poisons is 20 WBCT (20 minutes whole blood clotting time).

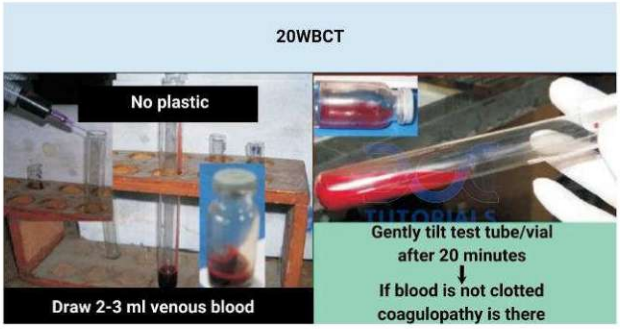

20WBCT
No plastic
Draw 2-3 ml venous blood
Gently tilt test tube/vial
after 20 minutes
If blood is not clotted
coagulopathy is there

Fig: 21

Snakes 00:27:23

Local signs

- Common krait → Almost nil
- Vipers → Maximum

Convulsions

- Common cobra → Most common
- Vipers → Nil
  - Tall peak T wave in ECG is associated viper bite (Haemolysis → Hyperkalemia).

If a snake bites you, what should you do?00:29:16

First aid

- Best is immobilization → application of splint
- Assurance
- Do not wash the area of the bite.
- No tourniquet application.
- No incision & suction.
- No ice application.
- Try to identify the snake/note the features.

Hospital treatment

- Wait and watch for signs & symptoms.
- If indicated → Begin PASV (Polyvalent anti snake venom) with 10 vials.
- PASV is effective against 1. Common cobra
  2. Common krait
  3. Russel's viper
  4. Saw scaled viper
- PASV produced by Hoffkine biopharmaceutical company neutralises venom of pit viper due to Para-specific activity.

Fixation of toxins

- Common cobra → neurotoxins get fixed at post synaptic region. Hence, neostigmine has a role.
- Common krait → neurotoxins get fixed at pre-synaptic region. Hence, neostigmine has no role.

Cantharides 00:41:37

Cantharides (Blister beetle/Spanish fly)

- It is used as an aphrodisiac agent
- May cause priapism
- Strangury

Scorpions 00:43:28

Fig: 22

- The scorpion venom is neurotoxic (predominant), hemotoxic & cardiotoxic (delayed toxic myocarditis).
- May cause priapism.

Plant	**Active Principles**
Ricinus Communis	Ricin
Croton Tiglium	Crotin (toxalbumin), Crotonoside
Abrus Precatorius	Abrin (Toxalbumen), Abrin, Abralin, Abric Acid
Calotropis	Calactin, Calatoxin, Calotropin, Uscharin, Gigantin etc.
Semecarpus Anacardium	Semecarpol, Bhilawanol
Plumbago	Plumbagin & Plumbagic acid
Capsicum	Capsaicin, Capsicin

NEUROTOXICS

Papaver somniferum/Opium poppy 00:00:14

- It is a somniferous poison

Fig: 1

- Opium (Afim) is the dried juice of unripe poppy capsule.
- Poppy seeds (Khas Khas) → non-toxic

Fig: 2

- Ingredients of opium

  a) Phenanthrene (Narcotic)
  - Morphine (10%)
  - Codeine
  - Thebaine (Acts as convulsant)

  b) Isoquinoline (Mild analgesic)
  - Papaverine
  - Narcotine

Morphine 00:03:48

- Consumption of morphine gives rise to

  a) Cheyne-stokes breathing → gives rise to cyanosis → purple hand

  b) Morphine secretes in stomach glands → hence gastric lavage is given even in parenteral route of administration.

  (Amphetamine, Barbiturate, Cocaine and Nicotine also secrete in stomach even in parenteral use)

  c) It causes severe perspiration that gives rise to subnormal temperature, and it is known as toxic hypothermia.
- Chasing the dragon is a method of inhalation
- 1:500 solution of $KMnO_4$ is used for gastric lavage in case of poisoning by opium.
- Ideal antidote for opium poisoning is naloxone.

- Opioid withdrawal produces a characteristic syndrome that may resemble viral illness
- Heroin is also called as smack → Diacetyl morphine

Inebriants 00:08:46

Alcohol 00:09:00

- 20% and 80% of alcohol is absorbed in stomach and intestine respectively.
- 90% of alcohol is metabolized in the liver.
- In a female, consumption of same amount of alcohol, the blood alcohol level in comparison to male of the same body weight will be 25% more.
  - This is because aqueous compartment is smaller in females.
- The ratio of alcohol concentration blood and urine is 3:4/1:133 (Due to tubular reabsorption of water).
- The amount of alcohol in 1ml of blood is equal o 2100ml of alveolar air.
- Alcohol gaze nystagmus → 40-100mg% (average 80mg%) (Blood concentration).
- Critical level of alcohol in blood above which there is impairment of driving is 0.15gm% or 150mg/dl or above.
- Marked muscular incoordination is an indication of severe ethanol intoxication.
- Fatal dose of absolute alcohol in an adult is 150-250ml consumed in 1 hour or 500mg% and above.

- Mc Ewan's sign → it is a myth
  - Alcohol cause mydriasis. But in stage of coma there will be miosis. On painful stimulus, the constricted pupil dilates and come back to the original position, known as Mc Ewan's sign → Helps to differentiate alcoholic coma from other causes.
- Pathological jealousy is diagnostic of alcoholic intoxication.
- **Holiday heart syndrome** is seen in Alcoholic intoxication (Aka, Alcohol-induced atrial arrhythmia)
- In chronic alcoholism, the following are seen.
  - Delirium tremens
  - Acute hallucinosis
  - Korsakoff's psychosis
  - Marchiafava–Bignami disease
  - Wernicke's encephalopathy
- Confabulation is seen in cases of Korsakoff's psychosis.
- Marchiafava-Bignami disease → degeneration of corpus callosum.
- Wernicke's encephalopathy → GOA - P
  - G → Global Confusion
  - O → Ophthalmoplegia
  - A → Ataxia
  - P → peripheral neuropathy
- The chemical used for qualitative and quantitative assessment of alcohol in the expired air is potassium dichromate.

- Gas chromatography with mass spectrometry is the best method for estimation of blood alcohol level.
- Widmark's formula helps in the measurements of blood level of alcohol.
  - To estimate amount of alcohol consumed

    a = cpr; or c= a/pr

    a → weight of alcohol in gram

    c → blood alcohol concentration in mg/kg

    p → body weight in kg

    r → constant (0.68 for males and 0.55 for females)
- Under IMV act 1985, permissible minimum blood alcohol level for a driver while driving is 30mg%.

Methyl alcohol 00:20:53

- Toxic effects are due to formic acid.
- Earliest symptom – severe abdominal pain
- Metabolic acidosis
- Visual defects
  - Snow field vision
  - Constricted visual field
  - Optic neuritis → Temporary blindness
  - Optic atrophy → Permanent blindness
- Fatal dose → 60-200ml
- Antidote for both methyl alcohol and ethylene glycol → 4-methyl pyrazole (Fomepizole) and ethanol.

- Both 4-methyl pyrazole and ethanol acts by competitive inhibition of alcohol dehydrogenase.
- Ethylene glycol is an anti-freeze agent (coolant).
- Ethylene glycol gives rise to tetany and is nephrotoxic.

Barbiturates 00:29:04

- Barbiturates causes hypothermia, constricted pupils, hypotension, cyanosis and stupor progressing to coma.
- Barbiturates → oliguria → concentrated urine → golden appearance
- Amphetamine is known as liquid gold.
- Barbiturates and CO poisoning cause cutaneous blisters and automatism.

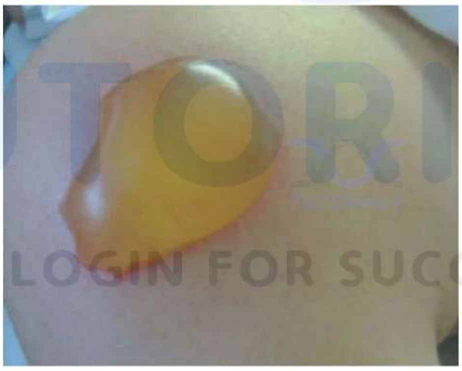


Fig: 3

- In salicylate poisoning the treatment recommended is forced diuresis. (Excretion of Barbiturate & salicylates in urine is increased by alkalization. Forced alkaline diuresis is done)
- Hemoperfusion with charcoal is useful in poisoning with barbiturate.

Chloral hydrate poisoning 00:34:09

- It is used a hypnotic
- Has a peculiar pungent odor
- It is crystalline
- Chloral hydrate is also known as 'Knock out drops' or Dry wine
- Mickey Finn → alcohol + chloralhydrate

Kerosene 00:35:31

- In kerosene aspiration pneumonitis
  - Fever occurs in initial few hours
  - Induction of emesis predispose to pneumonitis
  - X-ray appearance may precede clinical features
  - Corticosteroids should not be given because it may increase bacterial superinfection.

Deliriants 00:36:38

Datura

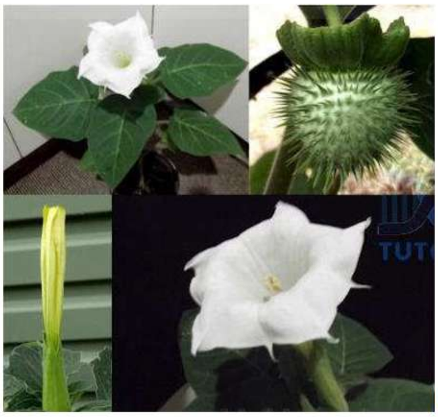


Fig: 4

- Datura stramonium is known as thorn apple.
- Datura seeds mimic chilli seeds.

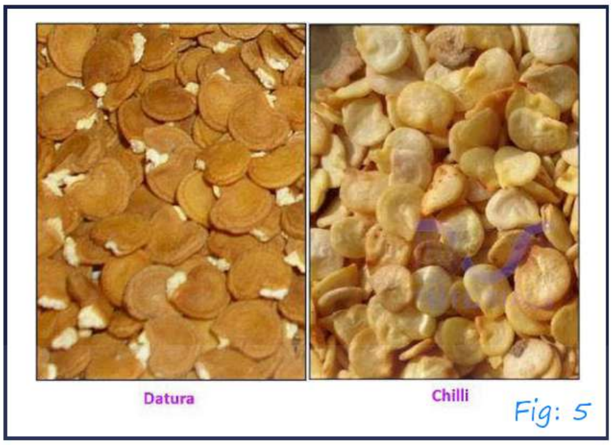


Fig: 5

- Differences between datura seeds and chilli seeds

  a)Datura seeds

  - Brown
  - Kidney shaped
  - Double edged convex border
  - Embryo curved outwards

  b)Chilli seeds

  - Yellow
  - Embryo curved inwards like figure '6'

- Active principles → Hyoscine, Hyoscyamine & traces of atropine
- Dilated pupil
- Cornpicker's pupil → Unilateral dilatation of pupil d/t pollens
- Suppresses the secretions of all glands.
- It is known as road poison.
- Other signs and symptoms:
  - Dermatitis (On contact)

  - Delirium
  - Dilated pupils
  - Dry hot skin
  - Dry membranes
  - Dryness of mouth and throat
  - Dysarthria
  - Dysphagia
  - Decreased muscle coordination
  - Drunken gait
  - Drowsiness
  - Dysuria
  - Delusions
  - Dreadful hallucinations
  - Death due to respiratory failure
- 'Carphologia' means pulling of imaginary threads from the fingertips or picking the imaginary objects.
- Antidotes of datura poisoning → physostigmine, neostigmine and pilocarpine.

Cannabis

Fig: 6

- Most common illegal drug abuse in world is cannabis. (Second most commonly used illicit drug of abuse is cocaine)
- Active principle →Δ-9 tetra hydro cannabinol (THC)
- Tests can detect THC in

  i. Urine – can be detected in 3-30 days after use

  ii. Saliva – up to 24 hours after use

  iii. Blood – 3-4 hours after use
- Cannabis

  a. Ganja – derived from female flowering tops. Contains 15-25% THC.

  b. Bhang – derived from dried leaves. Contains 15% THC.

  c. Majun – It is a sweet made.

  d. Hashish/Charas – derived from resinous exudate contains 25-40% THC.

  e. Hash oil – extracted from resinous exudates 70-90% THC.

Fig: 7

- Amotivational syndrome is seen in poisoning by cannabis.
- Run amok
  - Usually in chronic and rarely in acute intoxication by cannabis.
  - Due to delusion of persecution.
  - Takes a lethal weapon and go on killing people aimlessly.
  - Finally, may commit suicide/surrenders.

Cocaine (White lady)

Fig: 8

- It is derived from Erythroxylum coca.
- Method of drug abuse – snorting
- Crack
  - Cocaine + baking soda + water → Smokable form of cocaine
- Cocaine is metabolized primarily in liver, but alternatively, by plasma chE.
- Continuous snorting can cause nasal septal ulceration and perforation.

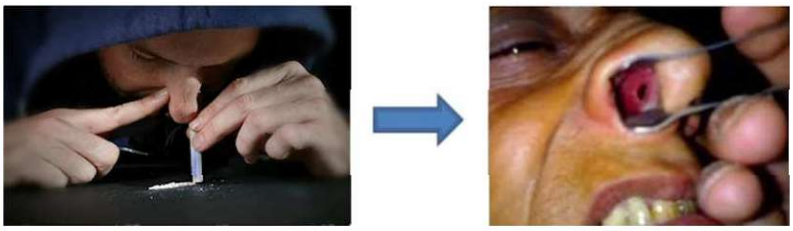


Fig: 9

- Causes black tongue and teeth.

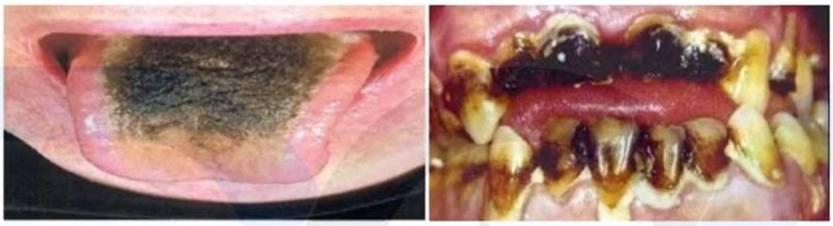


Fig: 10

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- Bruxism (grinding of the teeth accompanied by clenching of the jaw)-
- Crack eye - Corneal defects
- Formication
  - It means tactile hallucination.
  - It is seen in cases of
    a) Cocaine – known as Magnan's symptom/coke bugs/cocaine bugs.
    b) Amphetamine – known as meth mites
    c) Alcohol withdrawal
    d) Arsenic
    e) Ergot
- Gold chloride test is done in poisoning with cocaine.

Fig: 11

Atropa belladonna or deadly night shade

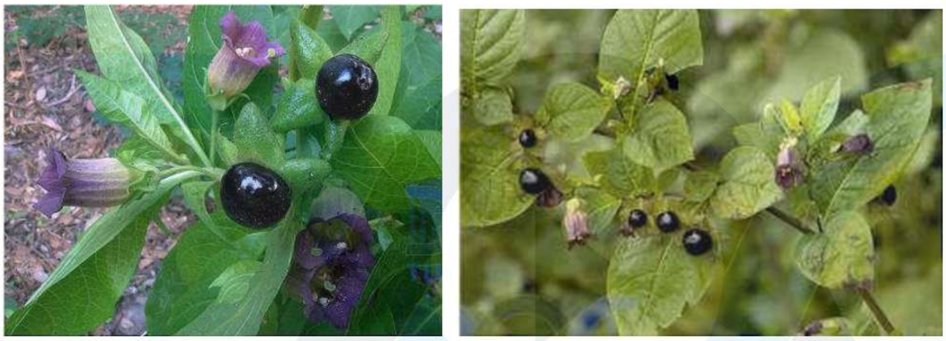

Fig: 12

- The fruit is known as Devil's cherries
- Active principles: Atropine, hyoscine (scopolamine), and hyoscyamine

Hyoscyamus Niger (Henbane, Black henbane, or Stinking nightshade)

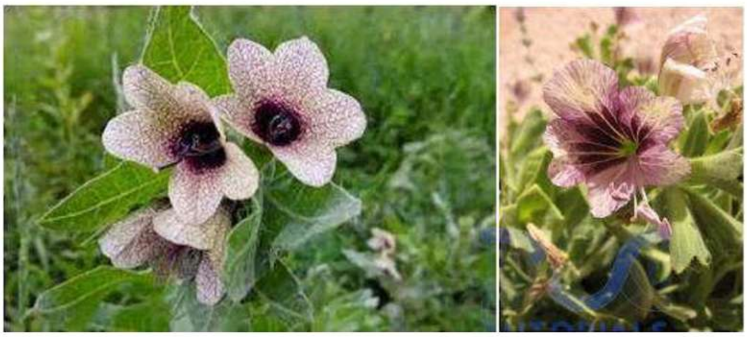

Fig: 13

- Active principles: Hyoscine (scopolamine), atropine, and hyoscyamine

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Psychotropics 01:00:51

Hallucinogens (psychedelics) 01:01:00

LSD

- It is also known as purple heart.
- It causes flashback phenomenon → Re-experiencing of a past Experience
- Bad trip → excessive fear/agitation/emotionally disturbing situations.
- LSD is known as mind expander.
- Cannabis

Phencyclidine

- Also known as PCP (Angel dust)

Mescaline

- It is from peyote cactus.

Mescaline (from peyote cactus)

Fig: 14

Magic mushrooms (Psilocybin and psilocin)

Magic mushrooms → Psilocybin & psilocin)

Fig: 15

Rave party/designer drugs 01:04:57

- Rave party/designer drugs
  - Ecstasy (Rave drug) → MDMA (methylene diamine methamphetamine)
  - Eve →MDEA (Methylene diamine ethamphetamine)
  - Love drug → MDA (Methylene diamine amphetamine)
- Date rape drugs
  - Alcohol
  - Chloral hydrate
  - Flunitrazepam (Rohypnol)
  - GHB
  - Ketamine
  - Ecstasy

SPINAL EXCITATORY POISONS

Strychnos nux vomica (Kuchila)

Fig: 16

Fig: 17

- Nux vomica seeds contains 2 alkaloids: Strychnine and Brucine.
  - – Loganine is a glycoside (Contains 3 active principle).
- Acts on Renshaw cells in anterior horn cells
  - – By inhibiting the neuroinhibitory enzyme 'Glycine'.
- All muscles go for spasm at the same time.
- Between fits muscles are completely relaxed.
- The convulsions are first clonic and eventually tonic.
- Strychnine acts by inhibiting glycine.
- Risus sardonicus – spasm of facial muscles

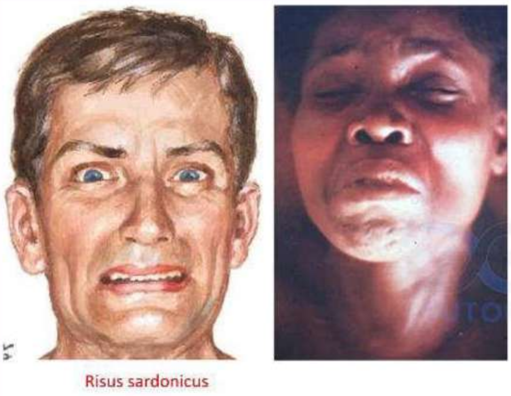

Fig: 18

- Later, it gives rise to trismus (lock jaw) → spasm of muscles of mastication. It is a late feature.

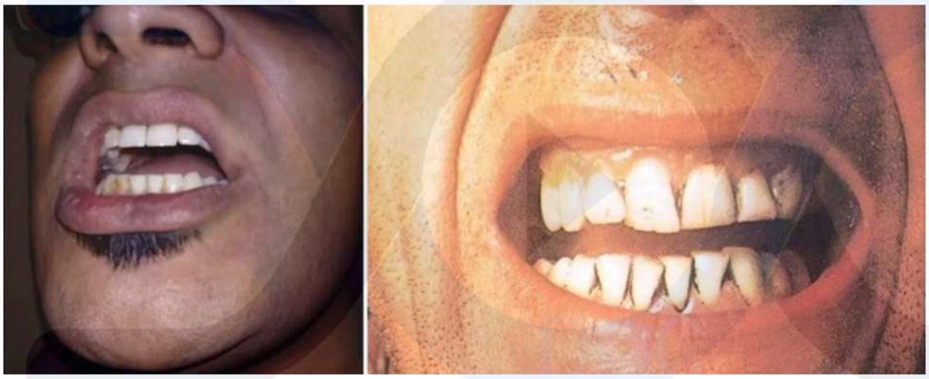

Fig: 19

- Strychnine poisoning mimics tetanus
  - Entire body may bend backwards – Opisthotonos (MC)

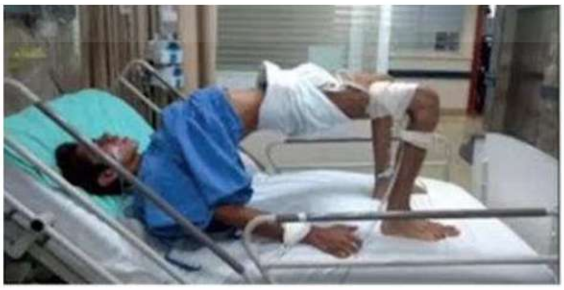

Fig: 20

  - Sometimes the entire body may bend forwards – Emprosthotonus

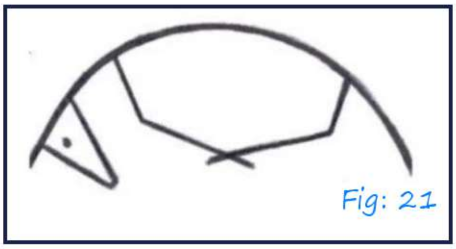

Fig: 21

- Rarely body may bend laterally – Pleurosthotonus

Fig: 22

- In case of strychnine poisoning, rigor mortis starts early and passes of quickly.
- Person retains consciousness till the end.

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Gelsemium

- It is a spinal inhibitory poison.

Fig: 23

- Spinal cord is preserved in strychnos nux vomica and gelsemium poisoning.
- Speed ball refers to Heroin + Cocaine
- Hot shot refers to Heroin + Strychnine
- Micky Finn: Alcohol + Chloral hydrate

Peripheral nerve poisons 01:16:10

Curare

Fig: 24

- Active principles – curarine and curine
- Antidote: Atropine followed by neostigmine

Conium maculatum (Hemlock)

Fig: 25

- Active principles: coniline, methylconiline
- Got mousy odor
- Greek philosopher Socrates was executed by Hemlock.

Autumn Crocus

Fig: 26

- Active principle: Colchicine
- Ethylene glycol is metabolized into glycolaldehyde and glycolic acid by ADH, so fomepizole is given as antidote.
- Valproate cause hyperammonemia with encephalopathy. Levocarnitine is given as antidote.
- Antidote for heparin is protamine sulphate.

Extra Edge topics 01:24:27

Alcohol

- Fats and proteins decrease the absorption of alcohol from stomach
- Rate of fall of Blood alcohol concentration is 15 mg% /hour
- Mebamoxine accelerates alcohol clearance from the blood.
- Most accurate breathalyzers work by using Infrared Spectrophotometer

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Absolute alcohol	>99.5% V/V
Rectified spirit	90% V/V
Denatured alcohol	95% alcohol + 5% wood naphtha
Proof spirit	50% alcohol
30 mg%	Maximum blood alcohol level permissible for a driver while driving as per Indian Motor Vehicle Act
50 mg%	Reaction time is impaired
80 mg%	Sensitivity to pain decreases
40-100 mg%	Alcohol gaze Nystagmus (Average 80 mg%)
80-150 mg%	Under the influence
150 mg or 0.15%	Critical level of alcohol
150-300 mg%	Drunk or intoxicated
500 mg% and above	Coma, and Death (Consumption of 150-250 ml of absolute alcohol in 1 hour is fatal)

Cannabis

- For someone smoking marijuana for the first time, urine test may detect THC for about 3 days.
- Who smokes marijuana three or four times per week, the detection window is 5–7 days
- Who smoke marijuana once a day or more, tests may detect it in their system for 30 days or longer?

Cocaine

- On smoking and IV administration
  - Onset of action is within 1-minute, peak action in 3-5 minutes;
- Nasal insufflation
  - Onset of action in 1-5 min, peak action in 20-30 min;
- Oral ingestion
  - Onset of action in 30-60 min, peak action in 60-90 min.
- Duration of action varies from half hour to 2 hours
- A nasal swab can be used to test for cocaine or other drugs taken by nasal insufflation
- Beam me up → Crack dipped in Phencyclidine (PCP)

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Plant	Active Principles
Datura	Hyoscine, Hyoscyamine, Traces of Atropine
Cocaine	Ecgonine, Hygrine, Cinnamyl cocaine
Belladonna	Atropine, hyoscine (scopolamine), and hyoscyamine
Hyoscyamus niger	Scopolamine, atropine, and hyoscyamine
Strychnos nux vomica	Strychnine (more potent), Brucine, Loganin
Curare	Curarine, Curine
Conium	Coniline, Methylconiline

ASPHYXIANTS

Asphyxiants (inhalational poisoning) 00:00:14

Carbon monoxide (CO)

- Hb has got 200-250 times greater affinity than O_2.
- It blocks cytochrome – A3 oxidase and P450.
- Hence, there is a leftward shift of oxy Hb dissociation curve.

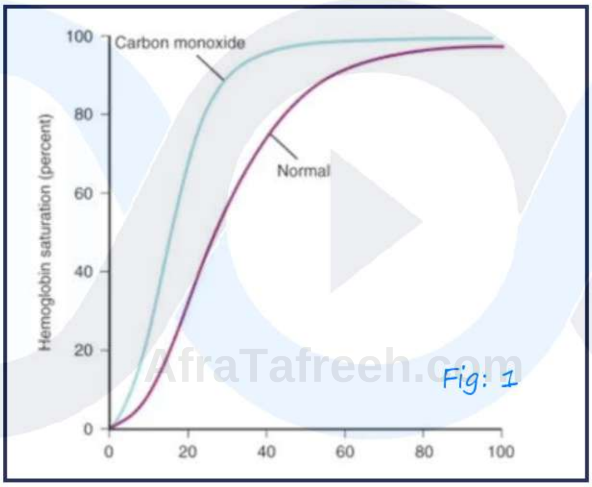

Fig: 1

- CoHb, >2% in non-smoker and >10% in smoker confirm exposure.
- Death is due to anemic anoxia/chemical asphyxia.
- Minimum concentration of CO to give rise to symptoms is >10%
- Minimum concentration of CO to give rise to cherry red discoloration is 40%.

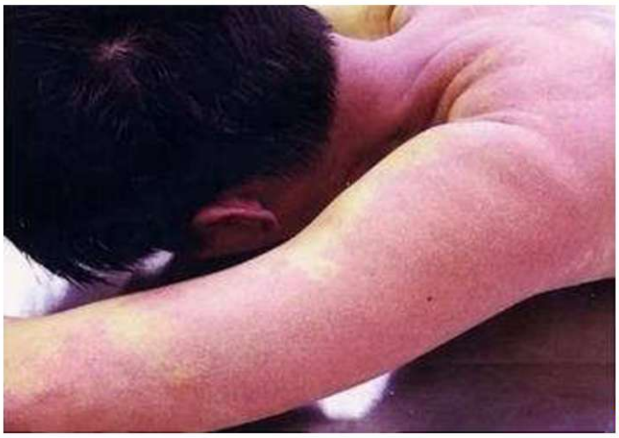

Fig: 2

- The clinical picture of alcohol intoxication is stimulated when blood CO concentration is 40-50%.
- Minimum level of CO Hb to be fatal is 60%.
- A rebound effect with delayed return of symptoms is due to late release of CO from myoglobin with subsequent binding of Hb.
- Cutaneous blisters are seen.

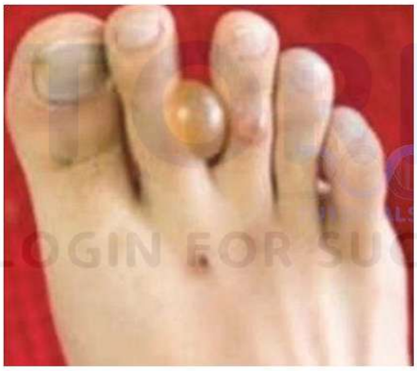

Fig: 3

- Bilateral symmetrical necrosis & cavitation of the lenticular nuclei (Basal ganglia) and Punctiform h'rhages in the white matter of brain

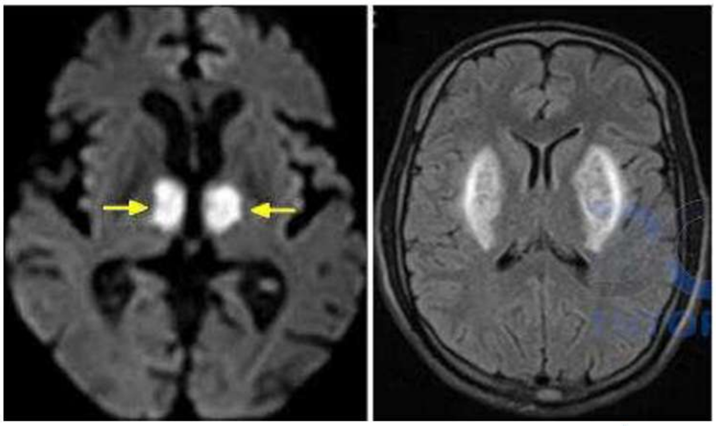

Fig: 4

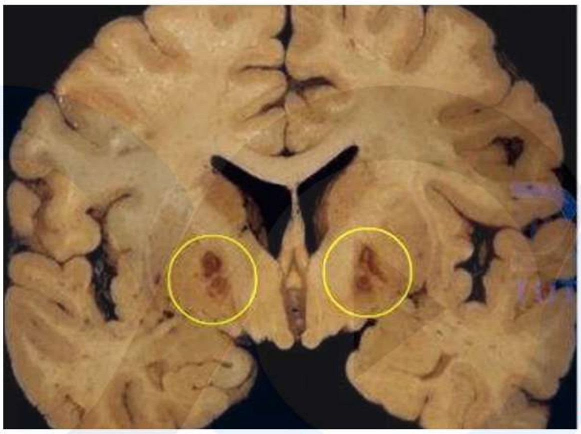

Fig: 5

- Treatment
  - Normobaric O_2
  - Hyperbaric O_2 in CO level >25% and in pregnancy >15%
- Diagnosis CO poisoning can be done by
  - Hope Seyler's test
  - Kunkel's test
  - Spectroscopy

Cyanide 00:07:45

- Cyanide acts by inhibiting the enzyme cytochrome c oxidase.
- It is an example of histotoxic anoxia.
- Double compounds of cyanide are non-poisonous. Example: potassium ferrocyanide
- Prussic acid means hydrocyanic acid.
- Cyanide gives rise to bitter almond smell.
  - It gives bitter almond smell; but 20-40% of human population cannot perceive the smell, which is inherited as sex linked recessive trait
- Prominent early signs of cyanide poisoning are hypernea, bright red blood, convulsions.
- Cyanosis is a late feature.
- KCN + HCl (in stomach) → HCN; Hence, achlorhydric people may be difficult to be poisoned by cyanide salts.
- In poisoning with hydrocyanic acid, nitrites are given in order to produce methemoglobin. (Methaemoglobin + Cyanide = Cyanohaemoglobin → Non-toxic)
- DOC in cyanide poisoning is hydroxocobalamin.
- Lilly cyanide antidote kit
  - Amyl nitrate
  - Sodium nitrate
  - Sodium thiosulphate
- The preferred solution for stomach wash in case of cyanide poisoning is sodium thiosulphate.

- Other antidotes are
  - Dicobalt EDTA (Dicobalt edetate/Kelocyanor),
  - Para-amino-propiophenone (4-PAPP)
  - 4- dimethyl aminophenol (4- DAMP)
  - Alpha – ketoglutaric acid
- The route administration of Amyl Nitrate in Cyanide poisoning is by inhalation.
- Amyl nitrite is also used as an antidote for H_2S and cocaine poisoning.
- Elevated level of cyanide may be seen in Thermal burns.
- Hydrocyanic acid type of cattle poisoning occurs due to the ingestion of linseed plant.
- Fatal dose of cyanide is 200-300mg or 50-60mg of Hydrocyanic acid (HCN).
- Bright/brick red hypostasis is seen in cyanide poisoning.

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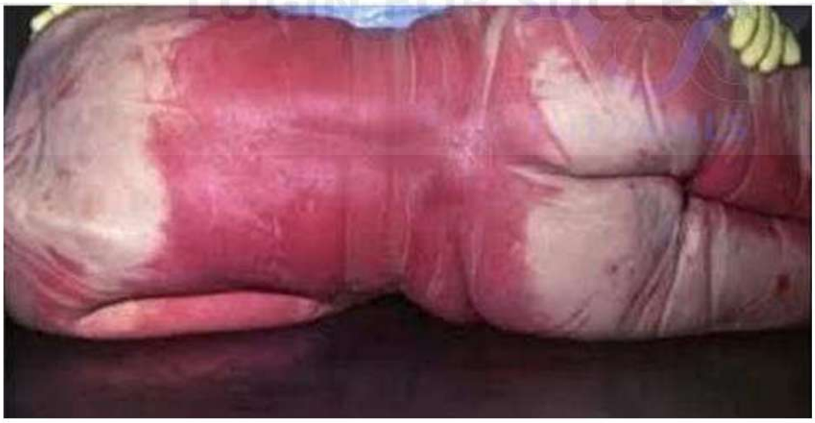

Fig: 6

- Rigor mortis starts early and passes off late.
- Asphyxia death with black colored mucosa of stomach is seen in poisoning with cyanide.
- Necrosis of Basal ganglia (Putamen) is seen in cyanide poisoning (Also seen in CO & methanol poisoning).

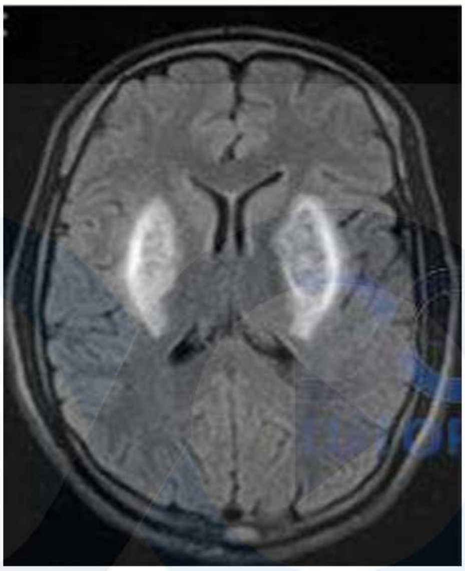

Fig: 7

- Best specimen for cyanide analysis is Spleen.
- Lee Jone's test is used for diagnosis of cyanide poisoning.
- Diffusion of oxygen at the tissue level is affected in Carbon monoxide, Phosgene and Cyanides.
- It causes skin blisters (Also in barbiturates and mustard gas).
- 'Japanese Detergent Suicide Technique' involves mixing of common household chemical to produce H_2S and other poisonous gases.

Asphyxiants

- Simple asphyxiants:
  - Inert gases which will not have any action on their own, and
  - Would not kill if sufficient oxygen is available
- Eg.: **H**: Hydrogen, Helium;

  E: Ethane, Ethylene;

  N: Nitrogen, Neon;

  C: Carbon dioxide;

  A: Acetylene, Argon;

  M: Methane; and

  P: Propane, Propylene

Carbon Monoxide

- Upper limit of safety of carbon monoxide in air is 0.01%
- Car exhaust contain 4-7% of CO and domestic gas contain 7-15% of CO
- CO blocks Cytochrome - A3 Oxidase & P-450
- Hyperbaric oxygen in CO poisoning is indicated in CO level >25% (In pregnancy >15%)
- Sewer gases may include hydrogen sulfide, ammonia, methane, esters, carbon monoxide, sulfur dioxide and nitrogen oxides

- CO2 and methane are the most commonly encountered suffocating gases.
- Diphenylamine chlorarsine is known as sickening gas
- Globus pallidus and corpus callosum necrosis are features of poisoning by
  - Amphetamine
  - Barbiturates
  - CO
  - Heroin
  - Cocaine
  - Toluene
- Necrosis of putamen is seen in poisoning by
  - Methanol
  - CO
  - Cyanide

CARDIAC POISONS

Cardiac poisons 00:00:08

Nicotiana tabacum (tobacco)

Fig: 1

- Tobacco heart: Irregular heart rate with occasional extra systole and angina.
- Causes toxic amblyopia with narrowing of field of vision.
- Bluish discoloration of neck of tooth due to nicotine.
- Addiction to tobacco can cause tremor, amblyopia, palpitations.
- Specific antidote for nicotine is mecamylamine (inversive).

Nerium odorum (pink/white oleander)

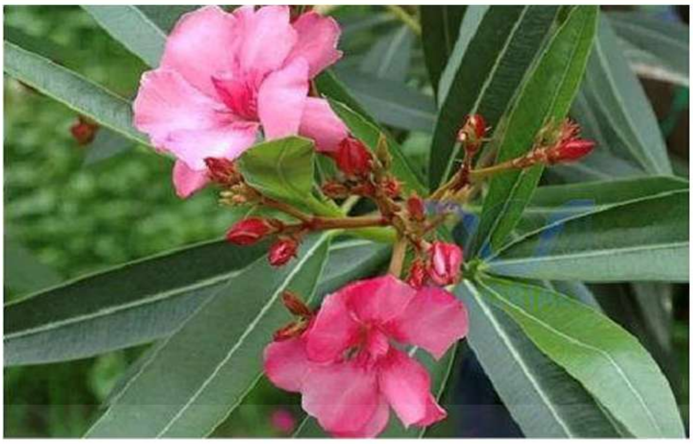

Fig: 2

- All parts of the plant including nectar are poisonous
- Causes hypokalemia and hypomagnesaemia

Cerbera thevetia/yellow oleander

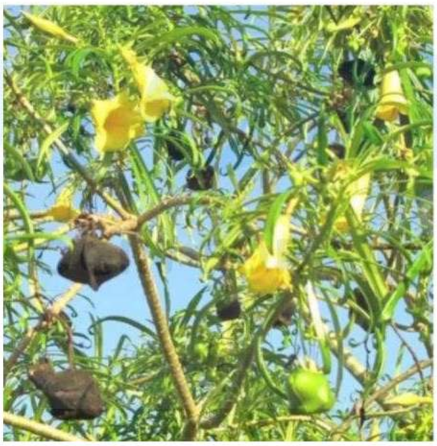

Fig: 3

- Causes hypokalemia and hypomagnesaemia

Cerbera odollam

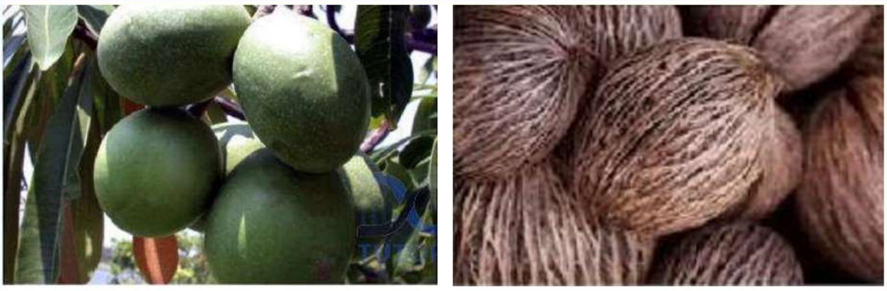

Fig: 4

- All parts of the plant including nectar are poisonous
- Causes hyperkalemia
- The fruit mimics mango.
- It is known as suicide tree or ordeal tree.
- Ordeal poison is physostigmine → Calabar bean or ordeal bean

Fox glove/digitalis purpurea

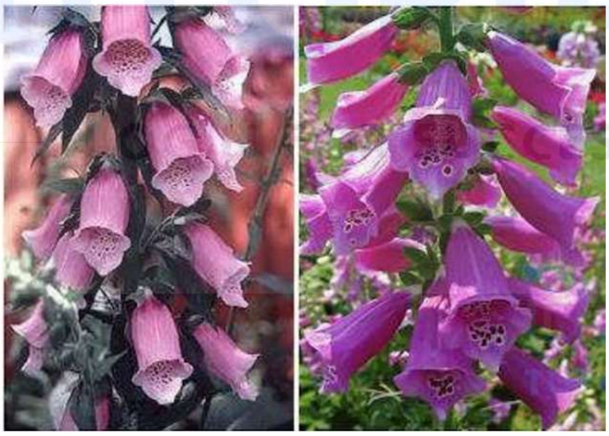

Fig: 5

Fig: 6

- All parts of the plant including nectar are poisonous
- **Specific antidote**: Digoxin-Specific Antibody Fragments (Digibind, DigiFab)
- Xanthopsia is seen in poisoning by foxglove.

Aconite/Blue rocket (Meetha bish, Meetha zeher, Wolfsbane)

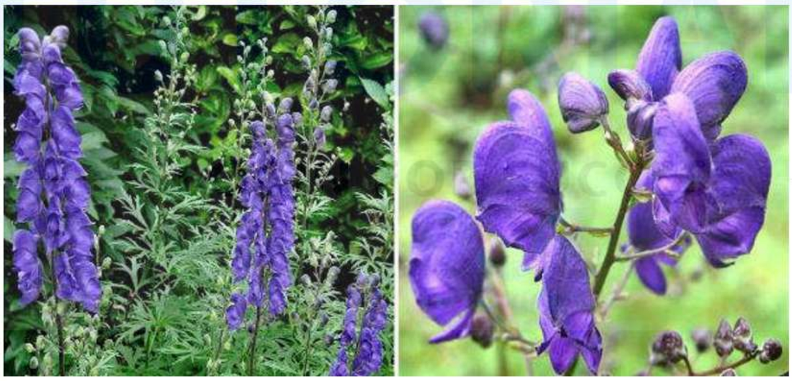

Fig: 7

- Flower is known as Monk's hood/Devil's helmet.
- Root resembles horseradish

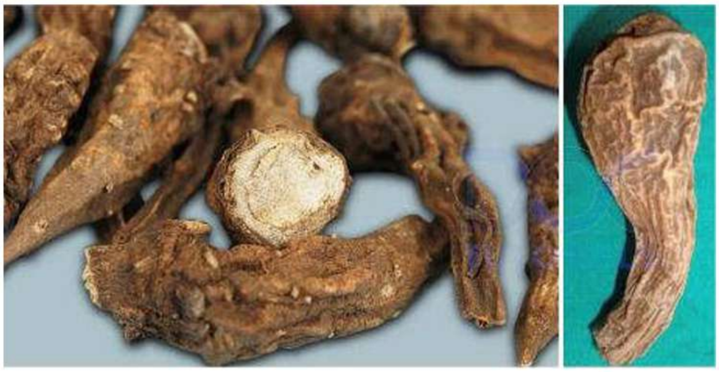

Fig: 8

- All parts of the plant are poisonous.
- Initially sweet later acrid.
- It causes AV block.
- It has no specific antidote; atropine is used in the treatment.
- Signs and symptoms
  - Tingling and numbness around the mouth
  - Hypersalivation
  - Chest pain
  - Hypotension, A-V block
  - HIPPUS, i.e., alternate contraction and dilatation of the pupil
- Fatal period is usually 1-5 hours

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Plant	Active Principles
Nicotine	Nicotine, anabasine, nornicotine etc.
Nerium Odorum	Oleandrin, Nerin, Folinerin, Rosagenin etc.
Cerbera Thevetia	Thevetin, Thevetoxin, Peruvoside, Nerifolin, Ruvoside etc.
Cerbera Odallam	Cerberin, Cerberoside, Odollin, Odolotoxin, Thevetin, Cerapain
Digitalis (Fox glove)	Digitoxin, Digoxin, Digitalin, Digitonin
Aconite	Aconitine, Aconine, Bikhaconitine, Picraconitine, Pseudoaconitine, Mesaconitine, Jesaconitine etc.

MISCELLANEOUS

Poisonous food 00:00:15

Amanita Phalloids (Death cap/deadly cyanic)

Fig: 1

- Antidote is benzyl penicillin

Amanita muscaria (fly agaric)

Fig: 2

- Antidote is atropine (?)

Yellow poppy → Argemone mexicana

Fig: 3

- On crushing the seeds, the oil contains sanguinarine & dihydro sanguinarine
- When adulterated with mustard oil, on consumption causes epidemic dropsy.
- Hyper secretory glaucoma is seen in epidemic dropsy.

DOC TUTORIALS FOR SUCCESS

Lathyrus sativus (Kesari dal)

Fig: 4

Fig: 5

- Active principle: Beta(N)–oxalyl amino alanine (BOAA).
- It causes neurolathyrism which give rise to spastic paraplegia/quadriplegia.

Ergot

- Active principles: Ergotamine, Ergotoxine, Ergometrine
- Eating food prepared from cereals infested with Claviceps pupurea causes ergotism.
- Ergot is used as abortifacient → ecbolic
- Ergotism gives rise to
  a. St. Vitus dance → convulsions
  b. St. Anthony's fire → Burning sensation, convulsions and delerium

Ichthyotoxicosis

- It refers to poisoning by fishes.
- Reversal of hot/cold temperature perception is seen in ciguatera fish poisoning due to altered Na^+ permeability

- In gymnothorox poisoning → prominent abdominal breathing & absent thoracic breathing.
- In scombroid food poisoning → allergic reaction
- Sweet clover disease → causes hemorrhagic disease

Botulism

- In case of food-borne botulism, the toxin is formed in the canned food before consumption.
- The fatal dose is 0.01mg (or) even less.

Substance abuse 00:07:23

- Mule is a body packer.
- A body packer swallow and pack their GIT with bags of illicit drugs in order to smuggle
- Body pusher → Conceal drugs in rectum/vagina/both.
- Body stuffer → Ingest drugs in possession to conceal the evidence from police.
- Best method to identify cocaine packets in the abdomen is CT scan.

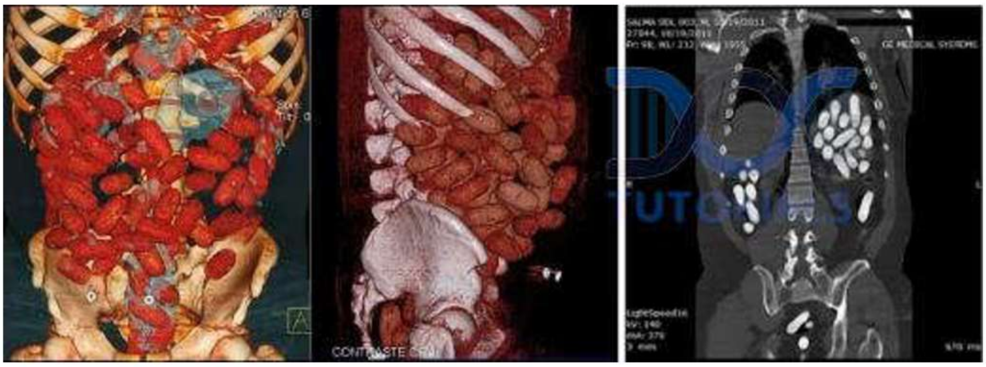

Fig: 6

- Mainlining is due to I.V. drug injection.
- Chinese restaurant syndrome is caused by monosodium glutamate.
- "Restless legs syndrome" is commonly caused by addiction to caffeine.
- Etheromania is dependence caused by ether.
- Individuals with G-6-PD deficiency are susceptible to poisoning by naphthalene.
- Methemoglobinemia is seen in poisoning with nitrites.
- Drug of choice for benzodiazepine poisoning is flumazenil.
- Mucomyst (N-acetylcysteine) is specific antidote for acute acetaminophen toxicity.
- The treatment of choice for paracetamol poisoning is acetyl cysteine.
- When a homicide case comes to a doctor, he should inform the police under 39 CrPC.
- Minimum punishment for selling spurious drug likely to cause death as per 'The drugs and cosmetic (amendment) Act, 2008' is 10years.

POISONOUS FOODS

Ciguatera fish poisoning:

- Caused by eating Reef fish, which produces ciguatoxin which alters the Na+ permeability giving rise to
  - Reversal of hot/cold temperature perception
  - Myalgias
  - Metallic taste and
  - Sensation of loose, painful teeth

Gymnothorax poisoning:

- Caused by eating Moray eals,
  - Giving rise to prominent abdominal breathing & absent thoracic breathing.

Scombroid food poisoning:

- Caused by eating spoiled fish
- The histidine is converted into histamine giving rise to

- Allergic reaction
- Diffused flushing of the skin and
- Peri-oral & peripheral paresthesia's

Sweet clover disease:

- The coumarin present in the sweet clover is converted into Vit. K antagonist dicoumarol
  - Giving rise to haemorrhagic disease

Botulism:

- It is an intoxication NOT an infection.
- Blocks the action of Ach at the MN junction. Acts in the cholinergic fibers of ANS
- "Cold turkey" → Refers to abrupt cessation of a substance dependence and the resulting unpleasant experience
- "Cutting In" → Term used for adulteration of heroin
- "Skin-popping" → Subcutaneous injection
- Dissociative anesthesia
  - Characterized by catalepsy, catatonia, analgesia, and amnesia
  - Seen in Phencyclidine (PCP)